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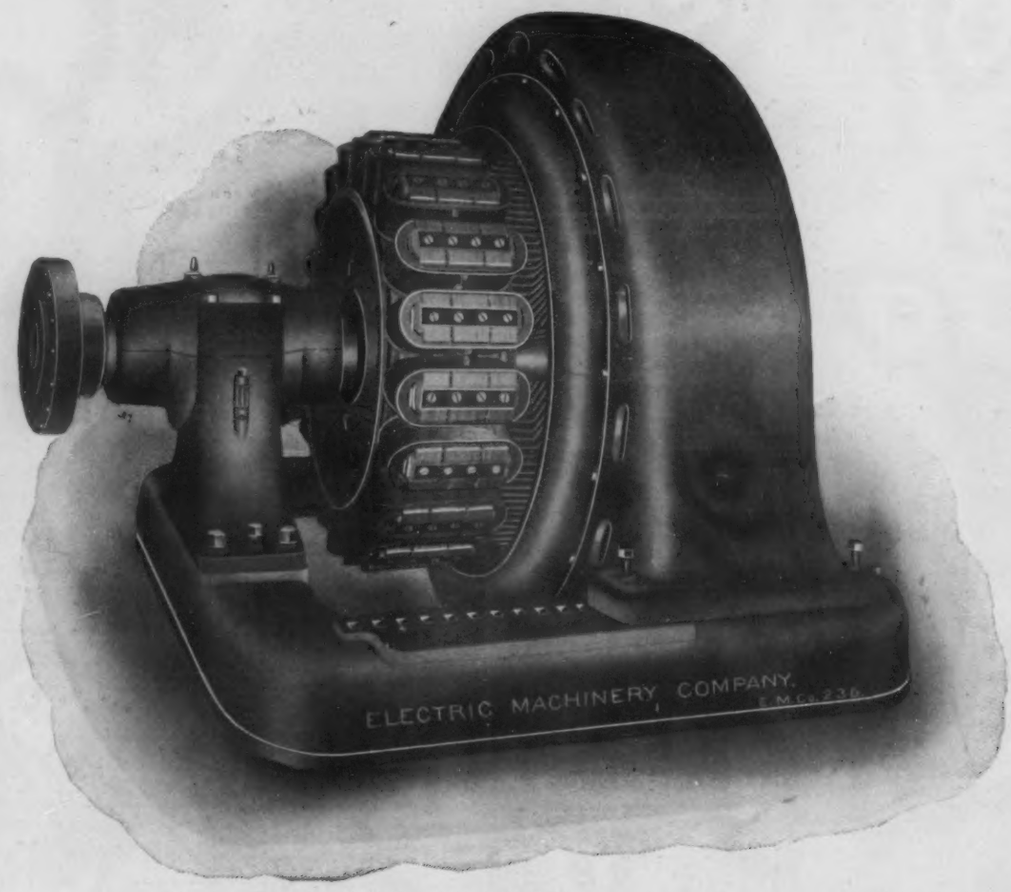

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Storage Battery Plant for Regulation and Carrying Peak of Load in Electric Mining

The accompanying drawing and illustrations show the arrangement of a storage battery plant, and accessory apparatus, as well as the generating station, for regulating and caring for the peak of the load in electric mining service at Gross Rhuden, Germany, at the Gewerkschaft Karlsfund mines. It is stated that this accumulator plant exerting a buffer effect on the rotary current system, and thus providing a uniform load on the generators, is the first of its kind installed recently by the Accumulatorenfabrik of Hagen in Westphalia.

The storage battery installation is used largely for regulation in railway service with great satisfaction, and on account of the great fluctuations in load attending most electric mining operations, it should give a good account of itself for this work. It stores the current, which is generated as a surplus, when the load is light, yielding it again during periods when greater power is necessary.

Most of the electric mining apparatus is subject to great variations in power required, the electric pumping and ventilating machinery alone being practically constant in the power used. The electric hoisting machines for main shafts of mines are particularly aggravating in the great variations

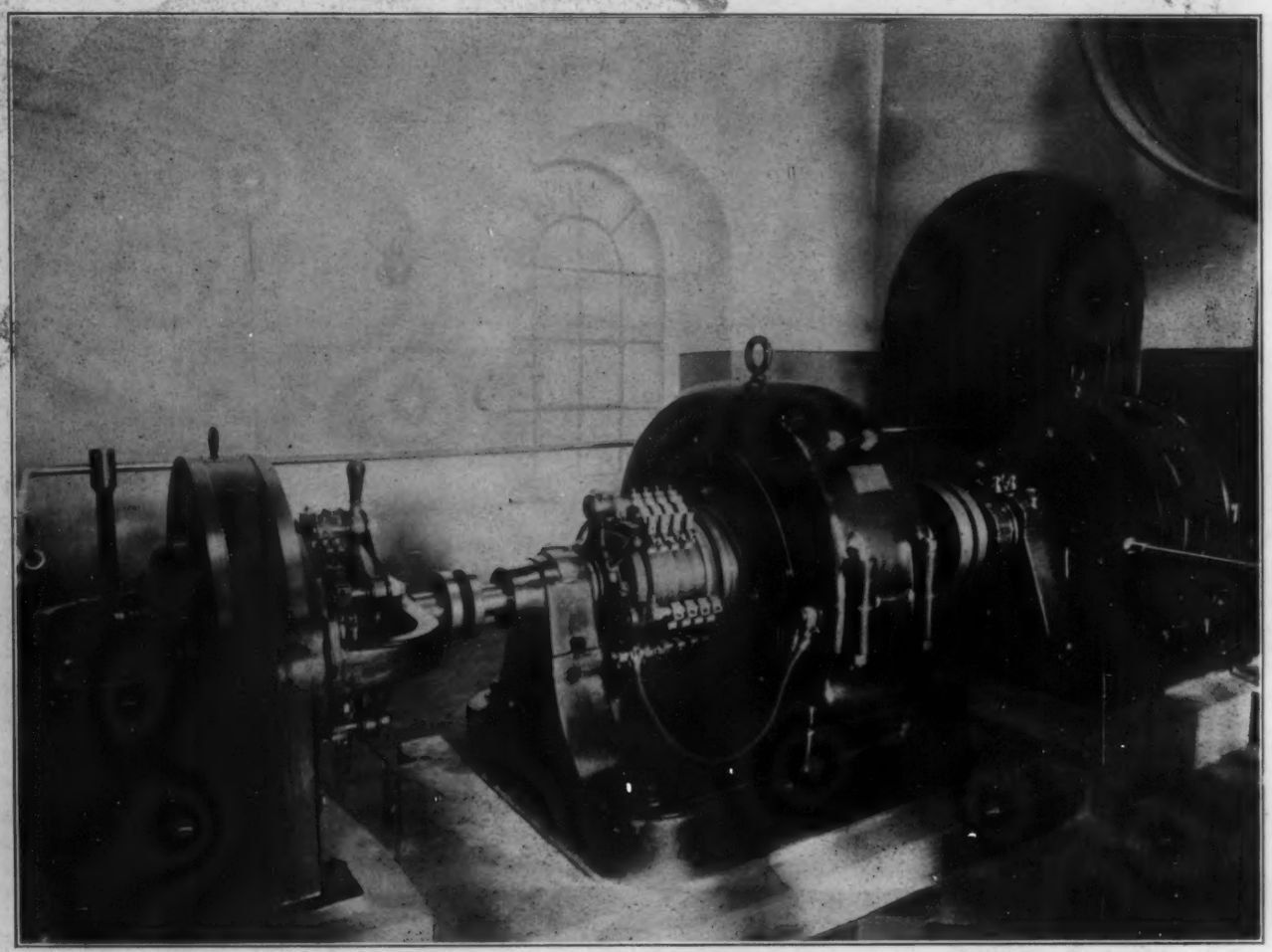

Fig. 1

MOTOR-GENERATOR SET

in load thrown on and off the electric generating installation, on account of the heavy current required in starting the cage with its loaded trucks, and accelerating the speed to a maximum and at the end of the travel, the current being entirely shut off, as the speed slackens and the cage is brought to rest at the upper landing, this being repeated at intervals of time causing serious fluctuations in the load.

The total average work done by the generating plant of a modern mine using electric power is often only 25 per cent. of the maximum load necessary at times, and the steam engines are therefore working at a disadvantage and in an extremely uneconomical manner, on account of the unsatisfactory load conditions.

The cost of fuel is therefore very much heavier than it should be considering the actual work done, and the high fuel consumption can be reduced only by storing energy during periods of light load and giving it back to the power circuits during heavy load.

At the Gewerkschaft Karlsfund mines a motor-generator buffer set has been installed, as shown in the accompanying illustration, Fig. 1, together with a buffer storage battery plant, consisting of 120 cells, each having a capacity of 648 ampere hours, 216 amperes being the charging and discharging rate.

This accumulator plant not only acts as a regulator or carrying the peak loads of the electric mining apparatus but is also used as a reserve for electric lighting service in case of emergency, and is employed for both light and power service when the steam generating plant noted in Fig. 2 is not in operation. This generating plant, as noted, is a belt driven installation, the main alternating current generator having a capacity of 100 kilowatts, with two other units of thirty-five kilowatts and fifty kilowatts capacity installed for reserve, although they could not be used to advantage. The load on the large machine was only about 30 per cent as an average, although at times the steam engine was unable to carry the load required during maximum service.

By the installation of the storage battery plant and motor generator buffer set, there was an increased economy in operating the main generator, as well as safety and reliability, for the battery provided the necessary compensation in the generator load and also gave a reserve plant for service in case of interruption of generation of current at the power plant.

The motor generator is placed in parallel with the main alternator, the storage battery plant being connected with the direct current end of the motor generator set. There is a transformer which feeds the converter mounted on the same shaft of the motor generator set as indicated in illustration, Fig. 1. It will be seen that the continuous current generated according to the series connection of the transformer with the drehstrom system, is proportional to the current strength traversing the latter and is employed for regulation by flowing through the coils in opposition to the separate excitation of the magnets at the direct current end of the motor generator.

When the drehstrom circuit has its current intensity increased, the potential is reduced so that the accumulator being discharged acts as a motor, and the drehstrom end of the motor generator set will supply a current to the rotary current circuit, while the current intensity in this circuit decreases, the tension is increased and the battery is in turn charged again.

This system is of great convenience and is most satis-

Fig. 2

STEAM ENGINE WITH 100 K. W. R. C. GENERATOR

factory in operation, as it is automatic and requires for its working no complicated switching mechanism, relays or other devices liable to get out of order.

The accompanying illustration, Fig. 3, shows the switchboard employed at this electric mining equipment, which includes twenty-five arc lamps as well as about thirty motors of a total capacity of 250 horsepower, together with over 1,000 incandescent lamps, the total connected load being about 300 kilowatts.

Until this installation was made the main alternator of 100 kilowatts capacity was required day and night, with an average load of 30 per cent., but since the storage battery plant and motor generator set was placed in operation, the smaller machine of fifty kilowatts output has been able to handle the load, with power to spare, during about seventeen hours of the day, the alternating current circuit being supplied with current from the accumulator plant during the remainder of the twenty-four hours by the aid of the motor-generator-converter set.

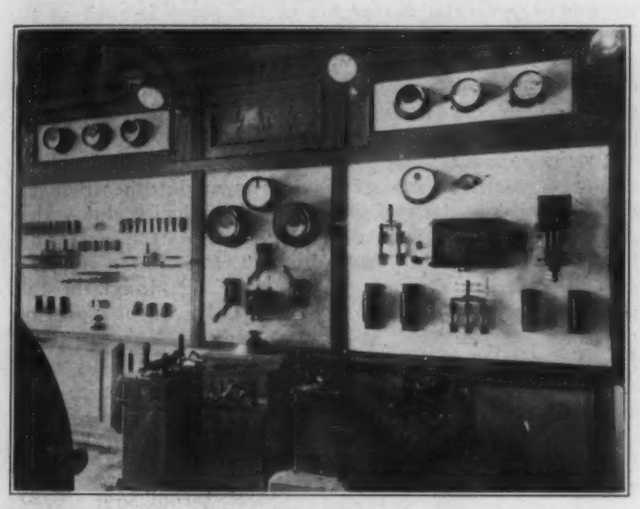

Fig. 3
SWITCHBOARD

It is stated that the potential at the bus bars of the a. c. circuit does not vary over 2 per cent., and self-recording instruments have been employed, the curves plotted showing most satisfactory results, the output of the main rotary current dynamo being kept at practically a constant output of twenty-five kilowatts, this being interrupted only by slight variations when two electric capstans were used. It is stated the cost of operation has been reduced one cent per kilowatt by this addition of the accumulator plant and motor generator set.

FOREIGN OBSERVATIONS.

The best shops, those that would best bespeak the industrial progress of the country, are closed to all visitors. Factories for automobiles, hardware, machinery, forgings, chemicals, dry goods, etc., which are freely opened to the visitor in America, are absolutely closed to every one here. There is no free, wide interchange of ideas, and with a few exceptions, the visitor is not received hospitably, and often discourteously. The methods and processes of each company are jealously guarded. Engineers entering the employ of some companies, have to sign an agreement that they will not work for another firm in the same line of work for a given term of years. If a person can procure several good letters to a particular firm, and bends every effort to visit that firm, he may succeed; but general letters and a mere formal application do very little good for the traveling man who wishes to see a great deal. A pleasant contrast to this has been the writer's experiences in and around Berlin, where shops, factories, power houses, pumping stations, etc., are opened and explained carefully to the visiting classes from the technical school. Power houses, hydraulic stations, etc., are never hard to gain admission to and many very fine equipments are to be seen all through Europe, as the frequent descriptions in the American technical papers testify, but with factories and shops, it is quite different.

In a recent trip from Berlin to Magdeburg on a motor cycle, we passed and visited many interesting places from an engineering standpoint, including water supply systems, sewage farms, potteries, canal works reclaimed land, low head turbine installations, and the magnificent roads, themselves, furnish rich material for the attention of any engineer. The water supply systems, as a rule, are driven by gas engines, and pump to stand pipes, or towers, supplying everything, from a small village enroute to the large cities. The whole country is marshy and cut up into canals, lakes or rivers, all draining, to a limited extent, into the Elbe. This water is all filtered, or aerated, before used.

The sewage farms outside of Berlin and Magdeburg are worthy of study. The sewage is pumped on to some and handled very similar to irrigation. On others it is hauled in a solid form and dumped. They smell terribly and while, obviously fertile, especially for feed or fruit, it is unpleasant to think of vegetables coming from such a place. The soil is sandy everywhere and well adapted to soaking up sewage. The reclaimed land is enclosed with huge dykes then pumped out and such land is, in some places, used for sewage farms

The channels are everywhere deepened and widened and used for traffic. At some places are locks and low head turbine installations. One installation was running on a head of not more than two feet and developing some seventy kilowatts with very little trouble.

The roads across this marshy land (of course, there are long sections through forests, etc.) have a heavy rock foundation, then riprap, then a top of concrete or fine cobble work laid as smoothly as a floor. The writer was traveling on a motor tandem, six horsepower, with a friend, and the whole distance was made in a little over four hours, making an average road speed of thirty to thirty-five miles an hour. One straight away stretch of twenty-one kilometers was made in less than twenty minutes. It would be hard to find an American every day road that would stand this speed. Furthermore, we road comfortably at all speeds and were limited only by matters of caution, as the tandem has made over eighty miles an hour on the race track.

N. C. PERCY.

CANADIAN HYDRO-ELECTRIC DEVELOPMENTS.

A scheme is on foot to utilize the tide in the Bay of Fundy for power purposes. A company has been formed under the name of the Cove Hydro-Electric Company, and its aim is to harness the Tantramar River at a point near Sackville. It is believed that 75,000-horsepower can be developed. If the plans of the company are carried out, work will be commenced in the Spring, and the plant will be in operation next Winter. Three dams will be needed in generating the power. Each will be concrete and will be sixty feet high. In length they will be 1,000 feet. The power house will be of the same height as the dams. Its length will be 800 feet and its width 42 feet. By means of the dams a reservoir and a discharge basin will be formed, the latter having the capacity of the reservoir. Turbines placed in the dams will give the power as the reservoir and basin empty and fill. A continuous flow of water is to be assured by the cutting of a channel in a narrow neck of land between two curves in the river. The power will be transmitted to Amherst, Moncton, and to other towns, as well as to Sackville.

DESIGN OF CENTRIFUGAL PUMPS.

By E. N. Percy.

The path of a particle of water in a centrifugal pump can be laid out graphically, with a fair degree of accuracy, for a given blade. In Figure 1, we have the water entering the runner at A, and with a direction and velocity B A, with a wheel velocity of A-D, and a resultant relative velocity A-C By well-known graphical methods, the path of this water molecule, as impelled by the blade, can be plotted to the point of exit F.

Assuming that the suction stream approaches the runner, parallel to the shaft, and spreads radially into the runner, it would seem that the entrance would be in a radial direction, at right angles to the radial movement of the wheel. This may be so, or the angle of approach may incline either side of the perpendicular. For a so-called fast runner, the angle, B A D. will be obtuse, and for a slow runner, acute; because, in the figure, where is indicated a "fast" runner, it will be noted that the path of the water bends sharply at point A., in a tangential direction. This will, apparently, cause a large shock loss, and, in many designs, there is a large loss here; as no part of a centrifugal pump is quite as important, or as hard to design, as the first 30 per cent of the blades, as here, probably, occur the greatest losses. In reality, as the blades suddenly force this water in a tangential direction, the water just back of it is, in a measure, forced in much

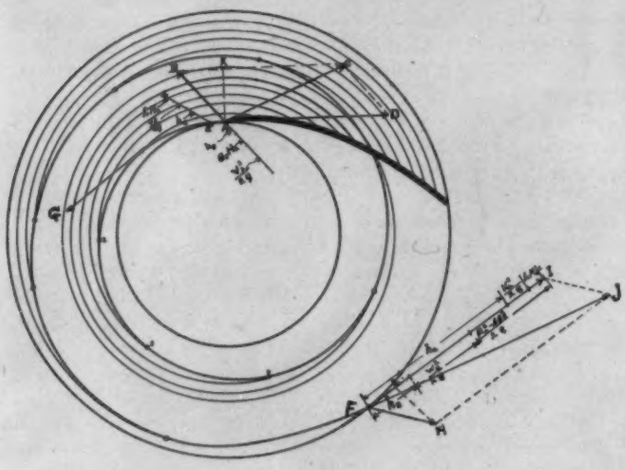

Fig. 1

the same direction by the atmospheric pressure, and velocity head; the external force, serving to effect a change of direction being merely to constant tendency of the water to follow the runner; partly through current and skin friction, but mostly from the inertia of the water expending itself in tangential velocity, because the port area of the runner, being less than the area of suction pipe, the radial velocity must increase, and in just that proportion, will the angle vary from the perpendicular to tangency.

On the other hand, if the runner be a very slow running one, so that the path of the water, radially, is comparatively rapid, and the blade have a considerable slant backwards (we will discuss blade design later), the angle B A D may be quite acute, and the path B F shorter, especially if there is an increase of suction port area, requiring a decreased velocity at the wheel entrance.

As this tangential action of the water is more or less uncertain, and as it is the source of important losses, makers have recently been putting guide vanes on the suction side of their runners, extending to the suction pipe, thus receiving the water radially, and guiding it to the runner, and delivering it at a positive angle, from which its further progress could be accurately determined. This apparatus adds about five per cent to the duty of a carefully designed pump, so far as the writer was able to determine, in some rather incomplete experiments.

We have the water now entering the runner with a velocity V from the suction opening, where it had a velocity V. Suppose in accordance with Fig. 1, that $V_s > V$ because of smaller port area. Let A K = V, then $\frac{V}{V_s} = \frac{\text{Area Port}}{\text{Area Suct. Pipe}} = \frac{AK}{\chi}$ A K Let A B be drawn equal to X, and touching parallel B. K. Let A. D. be tangential velocity of wheel, and complete the parallelogram, giving the resultant A C, relative to the runner. Now let B A equal total head at that point where h_a =plus or minus actual net suction head; $\frac{v_s^2}{2g}$ = net velocity head; and q_s h_n=total friction head, then

This represents the power exerted (+ or —) to bring the water to the point A. From a given blade, we plot the path of the water, with the given velocities; bearing in mind that the tangential velocity alone can vary. The radial velocity can only vary if the profile of the pump is such as to give a varying circumferential area. Taking circumferential elements from the blades, with any given unit of angular measure: the radial components can be carefully calculated according to the various governing circumferences, and plotted.

In calculating these radial components, one considers, first—the correction for entrance at an angle other than 90 degrees; second—the variations of radial velocity, due variations of radial area of cross-section, and third, the increasing head, due to centrifugal force, while not affecting the velocity, gives the series of pressures, affecting the design of the pump, especially the thickness of metal. Having the path of the water, we take the well-known formula for centrifugal force

$$F = 1.2276\ W\ RN^2$$

F=force; W=weight in lbs. (per second for water); R =radius and n=revolutions per second. Since the force varies as the radius, we need only take an average radius, from twenty or thirty ordinates on the curve, and the energy imparted to the water is easily calculated.

The water leaves the runner, of course, in accordance with the laws of centrifugal force, in a tangential direction. The length of F I can be found as follows: The radial component L H is unchanged, and therefore equal to A K, provided the wheel profile gives an unchanged section radially, to the water, and F. H is taken, again equal to A B; F I and H J extend indefinitely, parallel to each other. Before we can establish resultant F J, which is absolutely necessary for the design of guide or diffusion vans, we must have a correct value for F I. This must be built up. It could be plotted directly, by assuming the energy imported by the centrifugal force, expressed as velocity in a tangential direction; but this does not segregate certain quantities, which will be needed for later wirk. The velocity, tangentially, cannot exceed the velocity of the runner, and is equal to it, this gives a head $\frac{v_a^2}{2g}$. In addition, we have the friction head, f_a H_n, and the discharge head ha; the total of which, give the pump discharge head, F I. Now to obtain this head, we have had $\pm$ H_a, the suction head pressure, to begin with; F I—A D, or the head imparted by the wheel; and $\frac{W_a^2}{2g}$ or the velocity head. Thus, we have $N_a + \frac{v_a^2}{2g} + f_a H_n = N_e \frac{W_e^2}{2g} + \frac{FI\text{-}AD}{2g}$ giving in a clear form the relations between suction and discharge equations. Now let us change the value F. I. absolutely. Giving it only the value Va, or exit tangential velocity. Then have we our

resultant, F J, and from it the real direction and velocity of the water. Guide vanes, or diffusion vans, must have the beginning of their lead, parallel to F J Their further development will be treated later.

From the equation, let H=total head, or $H = h_a + \frac{v_a^2}{2g} + f H_n$. And as we know V and $f H_n$ (friction losses) are a matter of experience and judgment, h_a indicates to us the head, or pressure under which the pump is capable of working at a given speed. Of course, all of these diagrams can be analyzed to any extent by trigonometry and calculus; but that is unnecessary in a mere outline of method. In regard to what pumps actually do, it is hard to say, as so far as lift is concerned, one factor alone is affected, that is, the peripheral speed of the runner, and no manufacturer will give this. From personal and authenticated tests, the writer quotes following results:

500 ft. per min, raises water 1 ft. without discharge
1000 ft. per min. raises water 4 ft. without discharge
2000 ft. per min. raises water 16 ft. without discharge.
4000 ft. per min. raises water 64 ft. without discharge

Kent gives an empirical formula, that is very good, for quick approximations, since it is taken from actual tests:

$500 + 500\sqrt{H}$ = peripheral speed in feet per minute.

The efficiencies of commercial stock single stage pumps of good manufacture, running within thirty feet of the lift for which they are designed, will run from 50 per cent to 60 per cent. A test of such pumps, reported in Trans. A. S. M. E. IX., 237, and the tests, absolutely verified ran as follows:

Andrews, 3 pumps, ...46.52 % 53.00 % 57.57 %.
Heald & Sisco, 3 pumps 64.50 % 60.74 % 55.72 %.
Berlin, Schwartzkopff, one pump, 73,1 per cent.

High duty pumps are made as high as 85 per cent efficiency; and in Germany, makers will write guarantees for 88 per cent, and 91 per cent has been obtained.

Figure 2 shows a pump with which the writer was familiar, and is very characteristic of the better class of commercial pumps.

No problem, in regard to the centrifugal pump, is more puzzling than to know how many blades to give it. It is a matter in which there is a comparatively wide range, without materially affecting the efficiency of the pump. In ordinary pumps, not of very special design, the number of blades can run from six to fourteen or sixteen blades. The guide blades are usually about 20 per cent less in number. No mathematical construction will give an exact, preferable number of blades. If one has too large a number, shock and friction losses increase, the area of flow is too much reduced, and the runner becomes costly and heavy. If too few blades are used, the water is not well guided, it leaves the path more or less, to swirl and eddy, and the relation between entrance and exit calculations is partially destroyed. In general, high speed runners have fewer blades, and slow runners have more. Runners having blades bent forward, instead of back, and, consequently, delivering the water at a high tangential velocity and comparatively low radial velocity, must have as high as twelve to sixteen blades to preserve this relation; while recent, so-called "Kreisel" pumps, made in Germany, driven by steam turbines and running upwards of 20,000 (twenty thousand) revolutions per minute, have only three blades, and show a very good efficiency; but the friction losses are abnormally high. In general, it may be said that after the form of a blade is established for a given set of conditions, the entrance end of a blade should be approximately between the center point of pump and tip of exit end of next blade in front, making a point to choose one more blade rather than one less to fulfill this condition. In other words, it should not be possible to draw a radius that will not cut a blade. One the other hand, twice this number of blades can be used to advantage in many high duty pumps; and in addition, half blades are often used between the main blades, extending from about half way in the runner to the periphery.

The calculations will always show the limits or extremes in number of blade, because of reduced port area, long extremely narrow passages, or large bodies of water that are obviously too far from influence of insufficient number of blades. Hence, by the time all other calculations are finished, the number of blades is known from the conditions existing.

Returning to Figure 1, the radial velocity L H cannot vary, under the supposition that the port area is constant, but while $\frac{v_a^2}{2g} + h_a + f_a H_n$ = a constant for the same number of revolutions, $\frac{v_a^2}{2g}$ and H_a will vary with different forms of blades, although their sum is constant. As the outer tip of the blade is bent forward, $\frac{v_a^2}{2g}$ increases, and h_a decreases. This affects nothing but the design of the guide apparatus; but if the pump be without guide apparatus, then must it be so designed as to have the greatest possible tangential effect, as F. I, and the smallest possible component, F H, as the latter involves a shock loss. This is accomplished by varying the radial port era of runner, giving the blade the greatest angle the diagram will allow, and constructing casing as a guide apparatus. Having established the blade angles of entrance and exit, we have only to remember that its work is to bring the water gradually into circular,

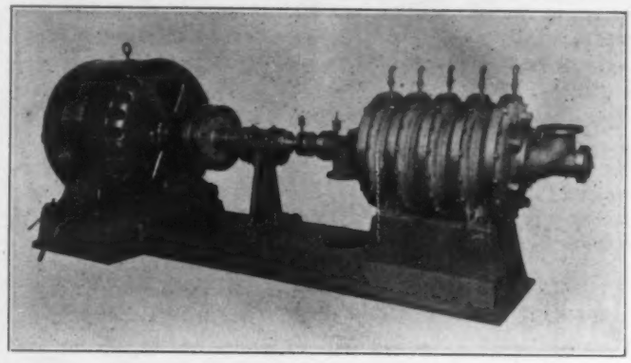

Fig. 2
CENTRIFUGAL PUMPS DIRECT CONNECTED TO ELECTRIC MOTOR

or more correctly, spiral movement, and again gradually bring it to the discharge, without a parting swirl from the blade tip. Therefore, the blade tips should be some gradually increasing curve, as a parabola, or involute, while the belly of the curve should be comparatively flat (not an arc), as its work is tangential, and the water should not be unnecessarily guided or turned, after having once been brought to the full spiral movement; as a matter of fact, this is done in all German designs.

Taking the entrance ends of successive blades, as in Figure 4, let us investigate the shock losses here. If the number of blades is "n," then $a = \frac{A}{n}$ and a stream of water of width "a," will approach the blades. Owing to the thickness of the blade, this area must suddenly be reduced from width a to width b, causing a shock loss. This loss is lessened by making the dip of the blades as thin as possible, and pointed, thus reducing the shock to a more gradual process. Again must the stream suffer a shock loss by increasing its velocity suddenly in the ratio $\frac{b}{c}$ because the projection of the blades offers a larger area than a section at right angles,

as through c. This is overcome absolutely by carefully aligning the blade to suit the flow of water according to the entrance diagram, and bending the blade tips to guide the flow gradually to greater velocities, if necessary.

Where we have blade tips cutting past guide or diffusion vanes, whether on suction or discharge, there may be serious losses. Take an arrangement as in Figure 5. The water flowing through d, must suddenly alter its velocity to suit h,

Fig. 3

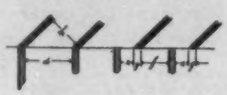

Fig. 4

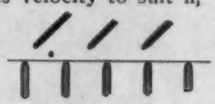

Fig. 5

and as the wheel moves to next position, the exit area of d is reduced by the amount g, in addition to the reduction due to D, the available area being only e +f, or d —g Furthermore, where guides and blades run so close to each other, any small object in the water is almost sure to wreck the pump. This also gives rise to constant shock losses from the water striking g. Therefore, it is advisable to separate the wheel and guide blades by several inches, to carefully point both, and to have dissimilar numbers of each, as shown in Figure 5.

The wheel profile is a matter to be carefully judged. It is best to design, or at least calculated with a uniform radial velocity; then can the profile be so varied as to give the radial component of the exit velocity any desired value, within the possibilities of the wheel.

The analysis of details of centrifugal pump will be taken up one by one, later. The writer has no wish to claim any of this as original, but as a compilation from standard authorities, and from pamphlets issued by various investigators and makers. After a review of analysis, will be taken up a summary of results, and discussion of types of pumps now manufactured.

THE PLAN AND SCOPE OF THE ILLUMINATING PROVISION, BUILDING OF THE ENGINEERING SOCIETIES. *

(For the following particulars of the plan and scope of the means taken for the illumination of the magnificent building of the Engineering Societies, West Thirty-ninth Street, between Fifth and Sixth Avenues, New York, we are indebted to the courtesy of Prof. F. R. Hutton.)

Complete specifications were prepared and sketches made by the consulting engineers, acting in co-operation with the architect, for the illumination of every room, and for every fixture in the building. It was realized by the engineers that the illumination was necessarily only one feature of the building and must be subordinate to, and in harmony with, the architectural features.

The central space in the entrance hall or foyer is lighted by means of individual lamps, placed in recesses, and concealed by panes of ground glass in the ceiling, at the sides of the rectangle formed by the columns around the large central area. In addition to this, larger crystal balls are provided in the outer corridor beyond the central space and in the elevator hall, entrances, etc. The effect of the individual lights in the recess, screened by glass, is to afford ample illumination without any glare.

Crystal glass balls, holding "metalized filament" lamps of various sizes, from 50 to 250 watts, are used on the principal floors, from the first to fourth, inclusive. In some cases pagoda reflectors are used inside the balls to increase the effective illumination and to reduce the current consumption. In other instances, however, in order to subdivide the number of lights in the hall fixtures, several lamps have been placed inside the crystal balls. In all such instances the metal plate at the top of the fixture supporting the sockets has been silvered to act as a reflector and to increase the efficiency as far as possible.

In the halls above the fourth floor, glass globes have been provided to screen the lamps. These globes, made according to the specifications of the electrical engineers, are unusual in the fact that the intrinsic brilliancy of the lamp is reduced without an excessive loss in the efficiency, and at the same time a warm, pleasing opal glow is produced.

The lighting of the auditorium is the most effective and probably the most interesting feature of illumination in the building The result was obtained by the complete co-operation of the electrical engineers with the architects. At the engineers' suggestion the architects provided a space of about 15 inches between the ceiling of the auditorium and beams of the floor above. At the suggestion of the engineers, also, a glass septum was substituted in place of the proposed plaster panels in the ceiling. The details were then carefully worked out as to obtaining access to the lamps for renewal, and tests were made by the engineers to find a glass that would reduce the intrinsic brilliancy or glare, and at the same time would not have an amount of absorption prohibitive on the score of economy. The result obtained has been very satisfactory, and it is possible to sit through an entire lecture without being disturbed or distracted by the lighting. The general effect is both soft and pleasing, and resembles or suggests sunlight passing through glass, as at Napoleon's Tomb in the Invalides, in Paris. As a matter of fact, the solid arches of the floor above are within 2 or 3 feet of the glass through which the light passes. Additional lighting screened by the same kind of glass is provided at the rear and at the sides under the balcony. Dimmers are provided for reducing the amount of illumination in the auditorium to any desired point, and also for the purpose of gradually increasing the lights to the maximum, after the room has been darkened for a stereopticon, thereby avoiding the unpleasant sensation produced on the retina of the eye, by flooding the room with light immediately following comparative darkness.

The lighting of the assembly and lecture rooms was also designed to prevent the lights from being distracting or unduly noticeable. For this reason, the cove method was adopted, with additional outlets in the ceiling for supplemental fixture lighting. The difficulties of the building construction, did not admit, in all cases, of obtaining continuous coves, nor coves of the exact form and dimensions desired. While the cost of lighting by this method is in excess of that using exposed lamps, the fact that the rooms are not in continuous use, but occasionally, for lecture purposes, offsets this objection.

The general illumination of the library is obtained by means of lamps placed above the glass ceiling skylight on a plan similar to that used in the auditorium, the glass in the ceiling skylights being of the same kind as that used in the auditorium ceiling. In addition, ceiling outlets are provided for general illumination, so that the indirect lighting above the glass need to be used only at certain times. The light for reading is obtained by means of standard fixtures placed upon the tables. The general effect is charming and agreeable.—

* From the American Gas Light Journal.

LIGHTING OF AN OFFICE BUILDING.*

(By Charles M. Cohn, Member.)

The chairman of the New York Section has requested a description of the lighting of the office building recently erected by the Consolidated Gas Company of Baltimore city, and although there are no features that are especially novel, these few notes have been prepared in compliance with his request.

Among the buildings erected in Baltimore shortly after the great fire of 1904 was the office of this company, whose former office building was destroyed on the first day of the fire. The site selected is a short distance beyond the limits of the burnt district, and is in the heart of the principal retail section of the city.

In the rebuilding of the burnt district, now almost completed, the company took advantage of the opportunity for the improvement of the system of house-piping, and was successful in having generally adopted by builders and architects the specifications formulated and recommended by the American Gas Light Association. The arrangement of the house-piping in the new building of the company was done in accordance with these specifications, which merely embody the ideas we advocate.

In the lighting of the offices of the company, the economy of the arrangement was carefully considered, but the matter of economy was subordinated to the broader questions of good illumination and ornamental lighting. The efficiency of the mantle burners made the matter of light absorption by suitable shades a matter of little importance. The mantle burners were used exclusively throughout the building, and the cylindrical shape of the mantles themselves aided greatly in the decorative features of the lighting.

The first floor, which is used by the public and by the office force coming directly in contact with the public, handling orders passing to and from the Distribution Department, is satisfactorily lighted by side brackets attached to the six pilasters at the sides and the three columns in the middle and side of the room. On each of the pilasters a five-arm bracket is placed, and on each of the two columns in the middle of the room four three-arm brackets, and on the column on the side of the room two three-arm brackets are used. The approximate number of square feet in this room is nineteen hundred, the height of the ceiling is fifteen feet three inches, and the lights are about nine feet above the floor. The brackets are of Flemish design, finished in brush brass, and are equipped with Enos socket burners, arranged for electric glassware. The generally recognized objections to the extended use of mantle burners—the unpleasant whiteness and glare—were overcome by the use of amber-tinted shades, sand blasted inside. It was to remove these disagreeable features that considerable effort was made to find shades that had a soft amber, yellow or pink tint, and in trying to procure shades of this character we communicated with a number of glass manufacturers and burner manufacturers, and we were told that nothing could be had at a reasonable price excepting the gaudy etched shades that are found so often in connection with cheap fixtures. It is a remarkable fact that so little progress has been made in suitable glassware for incandescent gas burners. We were, however, finally able to persuade a well-known glass concern to make up for us some special samples carrying out our ideas, and from these samples we found an amber-tinted shade so satisfactory that we at once secured a large number of them for our own use as well as for the use of our gas consumers. While we find this shade absorbs from thirty to thirty-five per cent of the light, it is very desirable and popular.

In the private offices on the upper floors of the building four and six-arm brush brass chandeliers of simple designs are used, amber-tinted shades being also used on these fixtures, some of which are equipped with Enos socket burners and others are the combination arrangement of fixture and burner known as the Enos Bunsen fixture. In addition to these chandeliers, swing brackets with Welsbach burners, fitted with Holophane Bobesches, with ten-inch opaline dome shades, are generally used for desk lighting, placed about four feet above the desk, and have been found very satisfactory in providing a soft and easy light for office work. The Bobesche shields are mantle entirely, and the white lining of the dome shades aids materially in the diffusion and distribution of the light.

The bookkeeping department and the drafting room of the Engineering Department, both being of nearly the same area as the first floor, are lighted with a number of single-mantle burners, connected with ceiling outlets, the burners having a white enameled metal chimney three inches in diameter and twelve and a half inches in height over a short clear glass chimney. They are a modification of the burner recently put on the market under the name of the "Lucas light." These lamps are finished in brass and white enamel, which form a pleasing combination, and have been found to be highly efficient, giving from thirty to thirty-five candles per cubic foot per hour of gas burned, and give a good distribution of light. They are of two hundred candle power each, and have been found, commercially, to be very satisfactory where an efficient light is desired for lighting large spaces.

Another attractive combination, which is used in the offices and in the toilet rooms, is a two-arm pendant holding a Welsbach burner with a Holophane globe fitted closely around and almost entirely covering the brass shade holder of the burner. An improvement in the shape of the globe so as to conceal as far as possible the brass shade holder was first suggested a few years ago by this company in its desire to improve the crude appearance of incandescent gas burners, especially when contrasted with the neater and more attractive appearance of electric burners. This combination is, of course, well known, and calls for no further comment.

In the planning and laying out of the piping of the building an abundance of outlets were allowed, and upon the completion of the building such of these outlets were used as were deemed necessary for good illumination. Practical experience was largely followed, with the result of an abundance of light throughout the building and a pleasing and attractive effect from the arrangement of the lighting and fixtures.

No attempt has yet been made to measure the amount of illumination at any one point, although a study of the conditions, showing the exact amounts of illumination on the desks, floors, and various parts of the room, is purposed on the first convenient opportunity.

*A paper presented before the Illuminating Engineering Society, March 8, 1907.

STEEL CITY ELECTRIC COMPANY'S NEW BUILDING.

Owing to the rapid growth of the Steel City Electric Company of Pittsburg, whose plant was located at Third Street and Penn Avenue, Pittsburg has become entirely too small, and in spite of the fact that they were running night and day turn in order to keep up with the orders coming in, found it useless, as in spite of their efforts things were becoming more congested every day, but now they have moved into their large new building, which is located at 1207-19 Washington Avenue, Allegheny, which is a part of Greater Pittsburg. Their new building, which will be occupied entirely by the Steel City Electric Company, is thoroughly equipped and is a modern building for manufacturing purposes. They expect, after getting comfortably settled and in first-class running order, to be able to take care of their rapidly growing business. The specialties that this concern manufactures are the celebrated star bushings, water-tight floor boxes, universal insulator supports, beam straps, conduit reaming device, conduit benders and locknuts.

HORSEPOWER RATING OF GAS ENGINES.*

By Mr. Henry C. Hart.

That there is a wide difference in the methods employed by manufacturers in arriving at the rating of the horsepower of gas engines is evident from the varying nature of the results arrived at, as shown in the claims set up by them regarding the merits of their respective engines of practically the same type and dimensions.

There is of course no mystery about the operation of a gas engine and the calculation of the horsepower of any given engine, or of at least its maximum possible horsepower, is a very simple matter by use of the method I purpose to set out in this article.

As there is no value to the power of any engine excepting its brake horepower, so should there be no other rating than that based upon the power that can be actually delivered if the individual engine was perfect in design and construction and properly adjusted.

It will be found that there is a certain value to the fuel burned which, although it varies with the type of the engine and to some extent with the dimensions, can not in any possible manner be exceeded, and in fact can only be attained by perfection in design, workmanship and adjustment, and it seems reasonable and fair that this possesses the basis of horsepower rating.

As the perfect adjustment of an engine means that the best possible mixture of the fuel with the air is being employed, it is not necessary in arriving at a proper rating to ascertain the fuel actually burned, but merely to measure or calculate the quantity of explosive mixture used; neither is it necessary to know exactly the quantity of mixture actually drawn into the explosion chamber and burned, but to know how much should have been so drawn in and burned were the engine properly designed, constructed and adjusted.

The basis of the rating then should be the amount of brake power the engine should be capable of delivering in proportion to the quantity of explosive mixture that should pass through it in a given time.

If 2 engines of the same pattern, made by the same manufacturer, are set side by side and operated under the same conditions, they should give the same results; if they do not, then there must be a difference in the workmanship or adjustment.

If 2 engines having the same dimensions, but of different makes, are set side by side and operated under the same conditions and the results are found to be different, then the difference must be due to the design, or the workmanship or the adjustment. Therefore we may conclude that a rating based upon the calculated fuel consumption under ideal conditions is a fair and proper one, and that the manufacturer who turns out his engine perfect in design and workmanship will be able to deliver the power at which it is rated, while imperfection of design or workmanship must inevitably be shown if the rating mark can not be attained.

There is, however, another factor to be determined, and that is the number of revolutions per minute at which the rating should be calculated. In every engine there is of course a "critical" speed below which or above which the power per revolution decreases from the maximum; in any 2 engines in which the design, workmanship and adjustment are the same and perfect, this critical point must be the same, and any imperfections in either must result in a lowering of the critical speed point and consequently in the maximum power.

It is, therefore, necessary in order to calculate the rated horsepower of our engine to establish a value for this critical speed in a perfect engine of any given dimensions; this is evidently a hard proposition to solve with accuracy, but it is practically already solved by practice, as it is pretty well known what is the limit of useful speed in gas engines; useful speed, however, is by no means the same as the most economical speed, neither is the most economical speed the best speed at which to run an engine unless its power is considerably in excess of the work it has to accomplish; for as a matter of fact the decrease in the power per revolution is very slight for quite considerable variations from the critical speed point.

For example, a single cylinder, 4-cycle gasoline engine having a piston 6 inches in diameter and 6 inches stroke, and in all respects perfect in design and workmanship should have a critical speed of say 500 revolutions per minute. If this speed is increased 10 per cent or to 550 revolutions per minute, there will be a loss of power per revolution of about 3 per cent, but if the speed is increased 20 per cent or to 600 revolutions per minute, the loss of power per revolution may be as high as 10 per cent, while at 700 or 750 revolutions per minute the total brake horsepower will likely fall below what it was at the critical speed of 500 revolutions per minute.

The critical speed of small gasoline engines—that is, engines below 12 by 12 dimensions—will be found not too far from 6,000 inches of piston speed per minute, and for the sake of uniformity it would be well if this speed were used exclusively in rating the horsepower of this type of engines.

Considerable experience with brake horsepower tests of small gasoline engines allows me to speak with confidence regarding this critical speed point, and with a conviction amounting to almost certainty regarding the proper co-efficient for the maximum power value of 1 cubic inch of explosive mixture as measured by the cubic contents of the piston sweep in 4-cycle engines.

This co-efficient varies somewhat according to the dimensions of the engine.

But I find that in very small engines—say 4 by 4 or less—that it is very difficult to so adjust and time the revolutions as to get results of 4-foot pounds of work for each cubic inch of explosive mixture; a 4 by 4 engine has a piston sweep of about 50 cubic inches. Better results can be obtained from engines having larger sweep of piston principally on account of the decreasing ratio of cylinder walls to piston sweep as the dimensions increase, this increase being modified very greatly by the necessarily diminishing speed and consequent increase in time of exposure of the hot expanding gases to the cylinder walls.

It is, of course, impossible to say what the proper work co-efficient is for every variation of size of engine, but I use the following values, and I know of no instance where properly conducted brake horsepower tests have shown better results.

For piston sweep of 50 or less cubic inches, work co-efficient per cubic inch of mixture equals 4.

For piston sweep between 50 and 100 cubic inches, co-efficient equals 4.5.

Between 100 and 250, cubic inches, co-efficient equals 5.

Between 250 and 750, co-efficient equals 5.5; above 750, co-efficient equals 6.

In very large gas engines of from 500 to 1,000 and more horsepower the co-efficient probably may be as high as 6.5 or possibly under test conditions as great as 7. It will be found, however, that by applying this method of computation to statements of work done in larger gas engine tests, claims for greater results than is shown by a co-efficient of 7 are seldom or ever made.

It is not at all unusual, however, to see it claimed that some particular make of small automobile or marine gas engines will develop brake horsepower equivalent to a co-efficient of 7 or 8 or more, but such results may be depended upon as being absolutely impossible under any conditions whatever and branded as false without a moment's hesitancy.

To calculate, then, the possible brake horsepower of any 4-cycle engine, it is only necessary to multiply the piston sweep by the number of possible working strokes per minute,

*From the American Gas Light Journal.

this result by the co-efficient and divide the result by 33,000. Or let the area of the piston be represented by A. The length of Stroke by S. The number of possible explosives per minute by R, and the co-efficient by C. Then

$$\frac{A \times S \times R \times C}{33{,}000} = \text{B.H.P.}$$

or in the single cylinder 4-cycle 6x6 engine at 500 revolutions per minute.

$$\frac{28.3 \times 6 \times 250 \times 5}{33{,}000} = 6.44$$

I am not able to speak so positively regarding the proper co-efficient that should be used in calculating the brake horsepower of the so-called 2-cycle engines, but the consensus of such information as I have indicates that the co-efficient should be at least 25 per cent less for the same dimensions than that for the 4-cycle engine.

For this engine, then, the calculation for 6x6 single cylinder engine should be

$$\frac{28.3 \times 6 \times 500 \times 3.75}{33{,}000} = 9.66 \text{ B.H.P.}$$

In large gas engines of the 2-cycle type, say 500-horsepower and over, the co-efficient does not vary much from that of the 4-cycle engines, as the sources of loss can in these sizes and speeds be nearly or entirely eliminated.

In small, fast-running gasoline engines, however, the 2-cycle type, though much more powerful for the same weight and room occupied, is undoubtedly much less efficient as regards fuel economy than the 4-cycle type.

This must not be considered as a criticism of this type of engine, for in my opinion the 2-cycle type has many advantages over its older brother for very many uses.

The writing of this article was suggested to me by reading an inquiry on page 47 of the "Gas Engine" for February, 1907, in which the inquirer wants information regarding the horsepower of a 6-cylinder engine of 12-inch bore, 14-inch stroke and a speed "calculated" for 257 revolutions per minute, and also information regarding propeller dimensions. As the inquirer does not give the type of engine or any suggestion regarding the boat the engine is to be used in, you were unable to give him much satisfaction. A calculation of the power of the engine according to the formulas suggested by this article shows that his engine, if of the 4-cycle type, is entitled to be rated as 185 brake horsepower, the critical speed being 214 revolutions per minute. At 235 revolutions per minute it would probably develop about 200 brake horsepower. If the engine is of the 2-cycle type, it is, according to our formula, entitled to rate as of 278 brake horsepower at 214 revolutions per minute and should develop about 300 brake horsepower, if run at 235 revolutions per minute.

FIRE EXTINGUISHING EQUIPMENT IN GAS WORKS.

It must be admitted it is somewhat anomalous that, in the majority of gas works, but scant provision has been made for extinguishing fires. The reason for this failure to recognize and provide for a contingency liable to arise at any moment cannot readily be determined. That fires seldom occur in gas works cannot logically be offered as an argument against not being prepared to meet the contingency of a fire and be in a position to reduce the loss and disturbance of the plant to a minimum. It must, however, be conceded that the demands on the gas works superintendent's time are so constant and multitudinous that it is not to be wondered some things escape his serious consideration, and the writer, therefore, feels that for this reason he is in order in calling special attention to the subject and referring in a general way to some important points in relation thereto. That "prevention is better than cure" is generally accepted as a true axiom. The elimination, then, of fire risks in every way possible is most desirable, some of which may be mentioned as follows:

(a) The location of oil tanks in as isolatcd position as possible.

(b) The elimination of all furred, lathed and plastered walls.

(c) The use of inclosed electric lights in all buildings where seals may blow.

(d) The use of safety waste cans.

STEAM HEATING VERSUS CONDENSING.

There are certain conditions under which the cost of ccndensing apparatus would not be warranted by the gain in economy which might reasonably be expected, says the "Electric Railway Journal." It is, therefore, fortunate that electric railway and lighting companies can in many cases develop a very profitable exhaust steam heating business if their power houses are not too far from the business district of a city. There was a time when it was thought that steam could only be sent a few hundred feet without being totally condensed. Such, however, is not the case, as has been proved by a large number of successful heating installations having miles of pipes under the streets, in which it has been found the condensation is not more than 10 per cent in extreme cases. The experience of one company, which found it economical to operate a heating system in conjunction with a railway and lighting plant, was reported recently. The plant is of about 1,000 kilowatts capacity and supplies a small railway and lighting system in a city having a population of about 28,000. Exhaust steam from the engines is distributed to the business district and a small portion of the residential district through about three miles of pipe under a pressure of from one to seven pounds. In small quantities, the exhaust sells for 50 cents per thousand pounds, and on the flat rate contracts based on the radiating surface, the return is about 35 cents per thousand pounds. The total income from the heating system was sufficient to pay the entire coal bill of the plant and the cost of repairs and maintenance of the heating system, and to show a balance of about $1,200. Besides furnishing the heat, power for the electric railway and street lighting was supplied by the steam before it was sold at the rates referred to. It would be difficult to imagine such returns from a condensing plant. As a further evidence of the profit to be derived from steam heating systems, it may be stated that there are small electric plants within the Niagara distribution district which are selling electric light and power at a lower rate than the Niagara companies and are deriving large profits from the investment in the plant and heating systems. Surely no more severe test could be given an enterprise of this nature than to operate it in competition with the cheap power from Niagara Falls.

The Alturas Electric Light & Power Company, whose plant is located seven miles outside the town of Alturas, Cal., has recently undertaken substantial improvements and additions to its present equipment. A contract placed with the Allis-Chambers Company includes 300 kilowatt Allis-Chambers' water wheel type generator, and a nine kilowatt exciter, also water wheel driven. The electrical machines are of standard design, the generator being wound for 6,600 volts, three-phase, sixty-cycle, and operating at a speed of 600 revolutions per minute. The Alturas plant, although built for electric lighting service, has heretofore been steam-driven and made no use of the water power, the installation of water wheels being an addition.

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EDITORIAL.

Gas as a Motive Power

A description of the processes of manufacture of the three principal kinds of gas and the difference in the heating value of coal, water and producer gas, including the relative cost of power using these three different kinds of gas, is treated very fully in an article presented recently by Mr. W. H. Laurie, to the Canadian Society of Civil Engineers. The conclusions of the writer as regards the cost of fuel per brake horsepower are rather startling, but the data contained in the paper is very complete and, inasmuch as the use of gas for power purposes is rapidly increasing, the figures given are worthy of careful consideration. Naturally, the heat units per cubic foot of gas are of the utmost importance where power is generated using explosive-mixture engines. At the same time the cost of manufacturing the gas depends upon the kind of gas made and its composition.

Four different kinds of gas are considered as available for the generation of power, viz., illuminating or coal gas, water gas, semi-water gas, and producer gas. Of these different kinds, the illuminating gas is by far the richest or highest in heat units, containing about 600 British thermal units per cubic foot. The second in point of calorific value is water gas, which contains about 300 heat units per cubic foot. The third is semi-water gas, having 150 heat units per cubic foot. The lowest in calorific value is producer gas, which contains not more than 110 British thermal units per cubic foot.

The following table indicates the approximate percentage of the principal constituents of the four different kinds of gases:

	Illuminating.	Water	Semi-Water	Producer
Carbonic Oxide	5.7	.42	25	23
	—Heading in 6-pt.—			
Hydrogen	46.5	48	19	2
Carbonic Acid	3.1	6	6	3.6
Nitrogen	3.7	5	49	63.5
Marsh Gas	35.7	.....	..	7.4
Heat Units, approximately	600	300	150	110

The wide variation between these four kinds of gases is indicated largely by the percentage of nitrogen, which, as will be noticed, in producer gas is many times greater than that to be found in illuminating or water gas. While the nitrogen in semi-water gas is less than in producer gas, it is very much greater than in either illuminating or water gas.

To show the relative power which may be developed with these four kinds of gases, a table is given where the standard is arbitrarily fixed as 100 horsepower for semi-water gas. This table is as follows:

Producer gas of 110 B. T. U.'s..... 90 horsepower
Semi-water gas of 150 B. T. U.'s.....100 horsepower
Water gas of 300 B. T. U.'s.....112 horsepower
Coal Gas of 600 B. T. U.'s.....117 horsepower

It is noticeable that producer gas is especially applicable for the generation of power when compared with the other kinds of gases considered.

In determining the relative cost of power, using gas, coal and gasoline, the conclusions as set forth in the article are extremely interesting. While it is impossible to definitely establish the cost per brake horsepower in different localities, where the cost of the raw materials may vary, yet the data given is sufficient to determine with a reasonable degree of accuracy the probable result.

Using gasoline with the assumption that one-eighth of a gallon is required per brake horsepower per hour, the cost per annum per brake horsepower is found to be $78, with gasoline costing twenty cents per gallon. With the steam engine, using coal and assuming one brake horsepower to be developed with six pounds of fuel, the annual cost per brake horsepower, with coal at $4 per ton, is given as $37.44.

Using illuminating gas in the modern gas engine, it is said a brake horsepower can be produced with from 14 to 16 cubic feet of this gas, or an aver-

age of 15 cubic feet per hour per brake horsepower. Assuming that the gas costs $1 per 1,000 cubic feet, the annual cost per brake horsepower is $46.80.

When semi-water gas is the source of power, the gas being produced from anthracite coal, gas engine builders will guarantee their engines to develop a brake horsepower for one pound of coal in the generator. If the coal so used costs $5 per ton, the annual cost per brake horsepower would be but $7.80. If semi-water gas is used, generated from gas coke, actual tests of an 80-horsepower electric plant show the fuel consumption to be .92 of a pound per brake horsepower per hour. With the cost of coke $4 per ton, the annual cost per brake horsepower would be but $5.74.

Using water gas manufactured in large plants, and engines having a capacity of over 500 horsepower, the consumption of fuel is given as .8 of a pound of bituminous coal per brake horsepower per hour, which, with a cost of $4 per ton for the coal, gives as the total cost per annum per brake horsepower, but $5. In all of the above figures it is assumed that power is required in a uniform quantity during ten hours of each day.

Assuming the above figures to be reliable, it is evident that the gas engine, with suitable gas producer, will generate power at a lower cost than any other fuel, considering only the cost of the fuel. This high efficiency, however, has only been made available within the past few years, and the reduced cost of power-using gas is due to the fact that the expense of manufacturing producer gas has been made much less than heretofore, and also on account of the important changes which have been made in the design and construction of the gas engines, particularly in large sizes. Much higher compression in engines of modern manufacture is used, and also gas is distributed at high pressure, thereby reducing the cost of necessary distributing mains, particularly where the fuel is delivered long distances from the generating plant.

The gas engine, when first introduced, received little serious consideration at the hands of engineers. This was probably due to the fact that the engine as a machine for the conversion of heat energy into mechanical energy had not as yet been mechanically perfected, but also primarily due to the fact that only illuminating or coal gas was available.

In the earlier forms of gas engines the fluctuation of speed during each revolution was so great as to prohibit their use for driving electrical generators. This difficulty has been largely overcome, and if the figures set forth by Mr. Laurie are to be depended upon, electrical power can be more cheaply produced through the use of gas engines than by using steam engines. Certainly, if lighting is the result desired, it is cheaper to use the gas as a source of power in gas engines, which are used to drive electrical generators to produce current for lighting, than to use the gas direct as a form of illuminant.

BOOK REVIEW.

United States Department of Agriculture, office of Experiment Stations, Irrigation and Drainage Investigations, announce the publication of Bulletin 183, Mechanical Tests of Pumping Plants Used for Rice Irrigation in Louisiana and Texas, 1905 and 1906, by Prof. W. B. Gregory, Tulane University of Louisiana.

This report gives the details of a large number of mechanical tests of pumping plants used for rice irrigation in Louisiana and Texas. Most of these plants use crude oil for fuel, and they are therefore of special interest to those using this fuel.

The bulletin also includes estimates of the cost of different types of plants and their cost of operation, showing that in most instances the high-class machinery is very little, if any, more expensive in first cost and very much cheaper in operation.

Applications for this bulletin should be made to the Director of the Office of Experiment Stations, Washington, D. C.

TRADE CATALOGUES.

General Electric Co.—"Electric Pumping Plants" is the title of Bulletin No. 4496, in which descriptions of two typical pumping installations of this type are given.

A beautifully illustrated and artistic brochure on General Electric Fan Motors, for 1907, has also just been issued.

Bulletin No. 4393-C contains subject-matter pertaining to small moderate-speed, engine-driven, revolving-field alternators.

REMOVAL NOTICE.

Oakland, Cal., April 19, 1907.

Journal of Electricity, Power and Gas,

Atlas Building, San Francisco, Cal.—

Gentlemen:—The General Electric Company have vacated the offices occupied by them for the past year in the Union Savings Bank Building, Oakland, and will take possession of its permanent offices on the tenth floor of the Union Trust Building, San Francisco, at which place the executive office of the company for the Coast will be located in the future.

The California Promotion Committee have just issued a topographical map of California. This map, in addition to showing all the railroad, steamship and oil pipe lines, etc., will contain statistics regarding the different cities and towns throughout California, with their population, and also much valuable information regarding mines and minerals, agriculture and horticulture. It will be correct in every detail and has been amended to date.

This publication is one of value and ought to be in the possession of everybody interested in the welfare of the State. The prices at which it can be obtained are given below.

Single copy in tube, ready for mailing, postage paid, 10 cents. In lots of 100 maps only, postage extra, 7 cents each. Single map, in redwood frame with glass, complete, ready for hanging (not crated) F. O. B. San Francisco, $1.00. Single map, framed complete, in crate, ready for shipping, F. O. B. San Francisco, $1.75. Set of five, framed complete, ready for hanging, and in one crate, F. O. B. San Francisco, $1.25 each. To induce the sale of the maps, framed, in lots of five, we will send the five for $6.25, and one extra framed complete, as a present for selling the five, all in one crate.

DEATH OF GENERAL EUGENE GRIFFIN.

Brigadier General Eugene Griffin, First Vice President and General Sales Manager of the General Electric Company, died very suddenly of apoplexy at Schenectady, N. Y., on the evening of April 10th. With his wife and daughter, he had come to Schenectady to witness an amateur play given by a local club, of which his son Hancock Griffin was a leading member.

Following the performance, while at an informal supper with a few friends, the General collapsed, expiring about an hour later.

This sudden death of General Griffin removes from the electrical world, as well as from military and social circles, a man of broad and keen intellectual interests. Trained as a military engineer at West Point, and serving as such with honor, he entered the business world as Second Vice President of the Thomson Houston Company. Upon the consolidation of this company with the Edison Electric Company, forming the General Electric Company, General Griffin became the First Vice President of the General Electric Company, holding this office until his death.

General Griffin was born at Ellsworth, Maine, on October 13th, 1855. After finishing a preparatory school education he entered West Point and graduated in 1875 with high honors.

On leaving the Academy he entered the Engineering Corps, the highest branch in the army service, serving as a second lieutenant, first lieutenant and later as captain. From 1883 to 1885 he was a Professor of Civil and Military Engineering and the Art of War at the Academy. From then until late in 1886 Captain Griffin was aid-de-camp on the staff of Major General Winfield Scott Hancock, and until the close of the year 1888 he was Chief of the Engineering Division of the Atlantic and the Department of the East. In 1889 he resigned from the army to take up electrical engineering work.

Upon laving the army Captain Griffin entered the service of the Thomson Houston Electric Company as Second Vice President. This position he held until 1891 when the Thomson Houston Company was consolidated with the General Electric Company. He was then elected to the office of First Vice President of the General Electric Company. In 1893 he was elected to the position of President of the Thomson Houston International Electric Company. He was also a director of the British Thomson Houston Company and the Campagnie Francais pour l'Exploitation de Procedes Thomson-Houston, Paris.

At the outbreak of the Spanish-American war, Captain Griffin offered his services to the United States Government. On word from Washington he organized the First Regiment U. S. Volunteer Engineers, of which he became Colonel This regiment was mustered into service in the spring of 1898. The following year, in January, he was promoted to the rank of Brigadier General. This title he held at the close of the war.

General Griffin was prominent in club life, being a member of the Union, Racquet and Tennis, University, Engineers' Ardsley Riding, and City Midday Clubs of New York City. He was also a member of the Metropolitan at Washington, the Somerset at Boston, and the Mohawk and Mohawk Golf Clubs of Schenectady and the City Liberal Club of London.

In engineering and army clubs General Griffin held membership in the following: Military Order of Foreign Wars, United States Military Academy Alumni, New England Society, Society of Naval Architects and Marine Engineers, Order of Spanish-American War Veterans, the Pilgrims of the United States, The Institution of Civil Engineering, Great Britain, and the American Societies of Electrical and Mechanical Engineers.

The funeral services of General Griffin were read at the Church of Transfiguration in New York City, a brief service having been held at the Mohawk Club in Schenectady on April 12th. The final portion of the burial services were conducted by Dr. Goodwin, who officiated at his marriage twenty-eight years ago. After the services at the church the body was taken to West Point where interment was made with full military honors. Colonel Scott, the present Superintendent of the Post, was a classmate of General Griffin's, and a full corps of cadets acted as an escort at the burial. All flags at West Point were half masted. As the procession left the chapel eleven minute guns were fired and after the salute at the grave a second salute of eleven guns was given.

The pallbearers were: C. A. Coffin, President General Electric Company; Colonel H. L. Scott, Superintendent West Point Military Academy; Hinsdale Parsons, Schenectady; B. E. Sunny, Chicago; Colonel H. F. Hodges, Major of Engineers, Washington; H. R. Bishop of New York, S. M. Hamill of Schenectady, and Dr. Louis Seaman of New York.

General Griffin was married in 1879 to Miss Allie Hancock, niece of General Winfield Scott Hancock. He is survived by his widow and two children, Priscilla Griffin and Hancock Griffin.

INDUSTRIAL

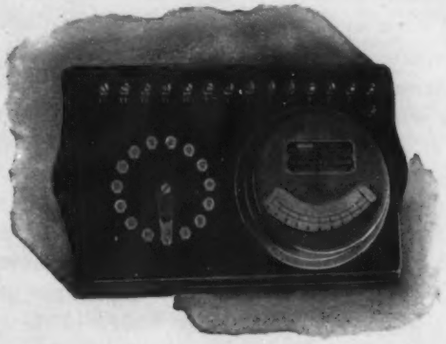
WESTON ELECTROPLATERS' VOLTMETER.

(Model 131.)

The importance of a reliable voltmeter in a plating establishment can hardly be exaggerated, as the amount of current consumed in a bath is governed by the quantity of work being done, and the current flow of course is dependent upon the voltage. Too much current (i. e., too high a voltage) results in burned work, while too little current (i.e., too low a voltage) results in a thin deposit, which comes off under the buffing wheel and necessitates replating.

An expert can readily detect the first difficulty early in the process, but the latter can only be determined by testing the work on a buff after it has been allowed to remain in the bath the usual length of time. The results being purely a matter of guesswork based upon the experience of the operator, it will readily be observed that the chances are greatly against running the plant at its maximum efficiency. In other words, it may be assumed that even if the results are generally satisfactory, it is quite probable that too much time has been consumed in the plating, or that the deposit is either above or below the desired thickness, and is not uniform on various classes of work.

With the aid of a voltmeter all guessing is eliminated and it becomes possible to operate any bath at its maximum efficiency, thus increasing the profit or reputation of the plater.



Owing to the apparently high first cost of furnishing each tank with a reliable and accurate voltmeter, platers have hesitated to properly equip their plants, and have used cheap, unreliable instruments, or have done without instruments of any kind. This is really very poor economy, as even an expensive instrument will soon pay for itself by increasing the quality and quantity of the output.

Realizing the importance of first cost from the plater's standpoint the Weston Electrical Instrument Company has designed a voltmeter specially adapted to this work, which obviates the necessity of having an instrument for each tank and enables the plater to avail himself of an extremely accurate and reliable instrument at a very low cost.

The instrument consists of an accurately calibrated Weston voltmeter, contained in an air-tight, waterproof case (which adequately protects the internal mechanism from the action of fumes usually present in the plating room), mounted on a small wooden switchboard containing fifteen binding posts and a fourteen-point switch. One of the binding posts, marked plus, is to be attached to the positive side of the plating generator or line, while the remainder are to be attached one each to the cathode side of each tank.

After the connections are made the voltmeter is thrown in circuit with any desired tank by turning the switch handle to the numbered point corresponding to the tank it is desired to test.

The instrument is designed to accommodate fourteen tanks, which is considered the maximum that can be conveniently operated from one point. Any lesser number of tanks may be connected in circuit, however, as each binding post is entirely independent.

THE ILLUMINATING ENGINEER.

As is now well recognized, the correct design of illumination for any given area is based on fundamental mathematical laws. The correct application of these laws, however, requires long experience, careful calculations, good judgment and a fine sense of the artistic. While it is generally best to take up any engineering problem directly on the ground, it is nevertheless possible, in most cases, to correctly design the illumination for any given area by a study of the plans and elevations of the building or room.

As an example of what it is possible to do by careful design may be mentioned one large public building recently completed. This building was originally designed for the equivalent of 20,000 sixteen candle power lamps. Although the outlets were not placed so as to get the maximum results, nevertheless by careful study of conditions, correct design of fixtures for illuminating as well as artistic effect, and the selection of the right glassware for each place, the load has been reduced to the equivalent of 15,000 eight candle power lamps, resulting in a saving of over $25,000 annually.

By the selection of scientifically constructed glassware, it is possible to obtain perfect diffusion and at the same time direct the maximum amount of light in the desired direction. This is one of the strongest features of the well-known Holophane System of Illumination.

In communicating with any of the Engineering Departments now being maintained by most up-to-date companies in this field, it is advisable to send drawings or blue-prints of the buildings to be illuminated, giving, if possible, the location of furniture, the uses to which each room will be put, color scheme, etc.

It is often possible to get good results in a number of different ways, thus affording rather a wide latitude in the matter of preference as to what method of illumination is wanted, such as ceiling lighting, bracket lighting, etc.

The Holophane Company has been a pioneer in the movement toward better illumination and has established an Engineering Department whose force is composed of some of the best known Illuminating Engineers. A large number of extremely efficient and artistic installations show the commendable results of the expert efforts of this staff, whose services are offered to those interested free of charge, whether or not it is desired to use the Holophane System of Illumination.

ELECTRICITY AT JAMESTOWN.

Electric power for the approaching exposition at Jamestown, like that at the Buffalo Pan-American fair, will come from a distance. Having no Niagara to rely upon, however, power for the Jamestown Exposition will be furnished by steam turbines located in the power house of the Norfolk Railway & Light Company, about seven miles from the Exposition grounds. This fair will be the first at which the electric power will be generated by steam turbines. The machines will be of the Curtis type, these as well as the complete electrical equipment being supplied by the General Electric Company.

The Exposition authorities have entered into a contract with the Norfolk Railway & Light Company to furnish all the electricity required for illumination and power purposes. The electricity generated at their Jamestown power house will be transmitted on specially constructed lines to a model substation in Machinery Hall. Here will be located the transforming and distributing apparatus. This equipment consists of large air-cooled transformers, many smaller type H transformers for general illumination, as well as constant current transformers for the series-arc lighting system which will be used for police illumination. At the substation also are motor generator sets to provide direct current for the operation of searchlights and small motors, where they may be installed by exhibitors.

The switchboard for controlling the various circuits throughout the Exposition grounds is located in a gallery and is typical of modern switchboard engineering. All the electrical machinery follows standard lines similar to that installed at the St. Louis, the Pan-American and other American expositions.

Those who have seen the plans for the Jamestown Exposition, predict that the electrical features, particularly the illumination, will equal if not excel the display at the famous Pan-American Exposition. Thousands of Edison lamps will be supplemented by searchlights both on land and on the fleets anchored in Hampton Roads, combining to make the nightly pageant magnificent and beautiful.

FOR YOUNG ENGINEERS.

The following rules for the guidance of young electrical engineers are said by Mr. H. Gilliam, in the "Electric Journal," to have had very good results:

1. Don't tell everything you know the first day you arrive to install apparatus. You may want to carry on a conversation the other days you are on the job.

2. Don't promise things that are not in the contract. The factory has a way of turning down such promises which makes you feel badly.

3. Don't think you know it all just because you are from a big company. There are a few smart men not working for your company.

4. Don't write letters to the local company; the factory has men who are paid to do this work of writing letters.

5. Don't say any more than you have to. By keeping your mouth shut you are likely to get the reputation of being a smart fellow.

6. Don't think because a man has worked all his life for a local company and you have just arrived, that he cannot give you a pointer or so. The dumbest people sometimes know a thing or two.

7. Don't take any one's word for everything being all right, but see for yourself. Trouble has a way of developing when least expected.

8. Don't forget what company you are working for, although the superintendent for the local company may say that the man before you would do "so and so." If you do not stick to the contract your company may have a man who can fill your place.

9. Don't forget that all of us make mistakes sometimes. It does not follow from this that you must make mistakes all the time.

10. Don't think that just because you have had the students' course you know more than the old road men. Some of the old road men have forgotten more than you ever knew.

11. Don't forget that the officials of your company have their eyes on you. Sometimes a position opens up and if you had worked hard you might have gotten it.

12. Don't think when you come in from a job that you are expected to hold the office furniture down. If no work is at hand look up some. Get busy.

ELECTROLYSIS IN ARMORED CONCRETE.

One of the strongest recommendations for the use of armored concrete, and for the use of concrete as a protective envelope for structural steel in tall buildings, is the fact, or the belief, that concrete effectually prevents the corrosion of the imbedded material. As far as we are aware, nothing has transpired where concrete has been used for structural or protective purposes under normal conditions, to shake this confidence.

The question has recently been raised, or rather revived, as to whether, under certain conditions, the steel of reinforced concrete may not be subject to the destructive effects of electrolysis. The revival of interest is due to some experiments recently made by A. A. Knudson of New York, and reported a few weeks ago to the American Institute of Electrical Engineers. The experiments were carried out as follows: Some blocks of one-to-one Portland cement sand concrete were molded in a common metal water pail, with a piece of 2-inch wrought iron pipe placed vertically within the blocks to a depth of about 8 inches. When the blocks were three years old, one of them was placed in a tank of sea water, and another in a tank of fresh water, and direct current was fed to the iron pipes in the center of each block, the negative electrode consisting of a piece of sheet iron placed in the tank. A third block, similar to the other two, was placed in a tank of sea water but was not subjected to the electric current. After a period of thirty days the last-named block was found to be in perfect condition and the imbedded pipe was perfectly bright. But the two other blocks, which had developed cracks during the test, were easily broken open; yellowish deposits were found in the cracks, where the concrete had deteriorated to such a degree that it could be cut easily with a knife; and the pipes were considerably corroded, showing a loss of weight of over 2 per cent. Similar results were obtained in tests with blocks of standard Rosendale cement, made in the same mold, although in this case the blocks were tested thirty days after they had been made. The cracking of the concrete appeared as early as the sixth day of the test, and by the eighteenth day they looked as though they might fall apart. One of the pipes showed a corrosion similar to the pitting action of underground electrolysis, a hole ⅜ by 1 inch being formed through the wall of the pipe.

It cannot be denied that these results are of profound

significance. They call for careful investigation on the part of concrete engineers, and the provision of special means of insulation in all cases where imbedded structural steel, or the reinforcing material of armored concrete, is liable to attack by stray currents in the neighborhood of wet foundations. The whole subject of electrolysis which, because of the exaggerated use to which it has been put by a sensational press, has not received from technical men the attention which it deserves, should be made the subject of a searching investigation with a view to determining the laws and limits of this form of corrosion.—Scientific American.

ALLIS-CHALMERS ELECTRIC MOTOR DRIVE FOR AN ALASKAN GOLD DREDGE.

The Bonanza Basin Gold Dredging Company, which has been operating during the past years in the Bonanza Basin district of Alaska, with steam driven gold dredges of Allis-Chalmers and other designs, recently made arrangements for obtaining a supply of electric current from the Dawson Electric Light & Power Company, of Dawson City.

In order to take advantage of the electric power which is now available, the Dredging Company has ordered the alteration of the big Allis-Chalmers dredge, which is the "sluice type," steam driven, to the "Stacker type," electrically driven.

This alteration necessitated the use of separate motors for each specific drive throughout the dredge, in addition to the substitution of new winches and gravel handling devices required by the change from sluice to stacker type. The current to be used will be alternating, three-phase, sixty-cycle, 2,300 volts.

The motor equipment will be made up of Allis-Chalmers standard induction motors, as follows: The bucket drive motor will be 100 horsepower, 2,300 volts, for variable speed and reversing. A fifty horsepower constant speed, 2,300 volt motor will drive twelve-inch pump. Two variable speed thirty horsepower, 440 volt machines will drive the main and ladder winches. A fifteen horsepower constant speed, 440 volt motor, operating at a speed of 1,130 revolutions per minute, will operate the screen and stacker hoist. The stacker will be driven by means of a constant speed motor, fifteen horsepower, 440 volt. A three inch primer pump will be driven from a ten horsepower constant speed machine.

The stacker for this dredge will have eighty-feet centers and a belt thirty inches wide, driven from the top end by a motor.

This dredge has already established for itself a rather unique record. One of the strangest "clean-ups" in the history of mining is reported to have been made from it, after a part of its run last summer in the sloughs of the Bonanza Basin. When the sluice box was opened preparatory to the periodical clean-up, after quite an extended period of operation, it was found that the bed of the slough, which had just been worked, had yielded an assortment of stuff, the equal of which, according to the papers of Dawson City, had never been seen before in the mining regions of the West. The collection disclosed among other things two Russian bronze ikons, or sacred figures, which had probably been carried into the region by Russian explorers many years before the Klondyke was heard of. These ikons were identical with those carried by some of the regiments of the Czar's armies in the late Japanese war. In addition to the ikons were found eight American pennies, probably thrown into the slough by some prospector in a fit of disgust, when he realized that they possessed no purchasing power in the Yukon district. There were also recovered about 100 pounds of unexploded cartridges; gallons of bullets, many of which had a coating of amalgam, which necessitated their treatment for the gold adhering; 120 pounds of nails of all sizes; an alarm clock; a saw set; two massive gold charms; an opal with its setting from a broken scarf pin; innumerable pieces of watch chains; knives, forks, keys, lock, native bismuth, etc.

During the season many large clean-ups were made, the gold was coarse and nuggets worth from $10 to $20 apiece were recovered.

LIVE WIRE DANGERS.

The British Chamber of Commerce, Genoa, has supplied the Manchester Chamber with particulars, prepared by the Association of Italian Manufacturers, Milan, of an international competition for the best scheme for the prevention of accidents from contact with live wires. The great extent to which electricity is used as the driving power in mills and works in the North of Italy compels the interest of Italian manufacturers in this subject. In the syllabus of the requirements it is stated that the invention must eliminate the danger of a contact (of whatever resistance) between the primary and secondary circuit of alternate current transformers and their respective lines. The apparatus must be simple, robust, economical and adaptable to existing installations. It must come promptly into action whenever the potential to earth of the low-pressure circuit reaches the double of the normal value in a three-phase and a two-and-a-half times the normal value in a single-phase system, and it must prevent the excess of potential becoming parmanent. The apparatus must not put the transformer out of action in the event of atmospheric discharges or of such partial reduction of insulation of service lines to earth as may be tolerated in practice.

San Francisco, Cal.—While waiting for the charter which will make their proposed union a reality the telephone girls of this city have been granted an increase of wages. The Pacific States Telephone Company, which does not like the union idea, announces that the new schedule went into effect April 1. This was a surprise to the girls, but apparently the sentiment in favor of organization is as strong as ever. The company does not admit that the increase was granted in the hope of shutting off the union. There was a report current in the union that some of the operators had been offered substantial increases if they would refuse to join the union. The girls are unanimously opposed to the acceptance of such terms. On the arrival of the promised charter, which is expected in a few days, permanent organization will be effected.

NEWS NOTES

ELECTRIC RAILWAYS.

Portland, Ore.—Preparations are being made to double track the Mount Scott railway.

Puyalup, Wash.—The Tacoma Railway & Power Co. is rushing construction of the electric line between this place and Tacoma.

Sumas, Wash.—It is reported that the survey for the electric line between here and Vancouver will be commenced at once.

Bellingham, Wash.—The Whatcom County Railway & Light Co. will lay new 60-lb. rails on Elk Street, Holly and Prospect Streets.

Montesano, Wash.—It is reported that the Grays Harbor Electric Co. will soon begin the construction of its road from Aberdeen to this city.

Walla Walla, Wash.—The Walla Walla Traction Co. is planning to construct an electric line from Spokane through this city to the Columbia River within the next year.

Tacoma, Wash.—The Tacoma Railway & Power Co. is completing the double tracking of the line to South Tacoma. Work has been resumed on South Fifty-sixth Street near Alaska.

Washington Water Power Company.—D. L. Huntington, general manager, has placed an order for 400,000 feet of underground ducts for its light and power wires, on which work will begin in May. The ducts are to be laid within the fire district, and the work contemplated will complete the underground system which was started.

Spokane & Inland Empire Electric Railway.—Jay P. Graves, president, announces that the company's engineers will make a preliminary survey of the branch proposed by citizens of Rockford, to run through that town and through the Rock Creek Valley into the Coeur d'Alene Reservation in Northern Idaho, and if they reported a good grade he will go over the route with outher officers of the company with a view to building the line

Columbia & Walla Walla Valley Traction Company.—Plans are being worked out to give the company a line from Spokane to the Columbia River by way of Walla Walla, Wash. J. H. Morrow, manager of the company, is in Spokane to enter negotiations with the Spokane & Inland Empire people for connections. Work on the Columbia & Walla Walla line will start in the near future, and the system will be rushed to completion as rapidly as possible.

Inland Power Company.—G. Scott Anderson, of Wallace, Idaho, part owner of the Big Creek water, right, upon which he and his associates have expended $20,000 to keep the proposition in life, has organized a company to be known as the Inland Power Company. The incorporators are: Stephen P. Wright, Butte, Mont.; G. Scott Anderson, Wallace; Maurice W. Bacon and William H. Hall, Butte, Mont.; and James J. Maloney, of Chicago. The stock is fully subscribed. Work will begin in May.

Inter-Valley Traction.—Two hundred and fifty miles of electric motor roads will be constructed in Central Washington by The Inter-Valley Traction Company, which has just received a franchise to use the Yakima County highways, west of Spokane, for fifty years. It is estimated by H. B. Scudder, president of the company, that the line can be built and equipped for $10,000 a mile. E. M. Kenly, chief engineer, announces that the first line to be built this year will be to Zillah, twenty-five miles southeast of North Yakima, to Moxer Valley and Parker; the second will run west to Wide Hollow with a loop through Fruitvale; the third to Ahtanum Academy, and the fourth to Cowiche Valley, in all, sixty miles.

Gasoline electric motor cars will be used on the line, each engine having sufficient power to haul several passenger coaches with seating capacity for forty persons, and freight cars of sixteen tons capacity will also be operated. The company expects ultimately to tap the headwaters of the Yakima River, tapping rich farming, timber and mineral districts. Money is being raised by subscription, and it is given out officially that the capital stock of $250,000 has been fully subscribed. The officers of the company are Yakima men, as follows: President, H. B. Scudder; vice-president, W. A. Bell; secretary, M. B. Miles; treasurer, W. L. Steinweg; trustees, A. J. Splawn, Alexander Miller, I. H. Dills, D. E. Lesh and William P. Sawyer.

Northwestern Corporation.—Isaac W. Anderson, of Spokane, president, announces that among the plans for the immediate future of the company, a $5,000,000 concern, recently incorporated, controlling the lighting and power of nearly a score of cities in Washington, Oregon and Idaho, are the construction of a large power plant in Oregon; the building of a great railroad in the Willamette Valley; traction lines in the city of Eugene, Ore.; and interurban lines in that vicinity; and the extension of traction lines in Walla Walla, Washington. The properties consolidated are:

The holdings of the Northwestern Gas and Electric Co., at Walla Walla, consisting of a gas plant; a power plant on Mill Creek; power plant on the Walla Walla River, capable of generating 3,000 horsepower, and supplying power to Walla Walla, Pendleton and Milton; also the city electric system of Walla Walla and the interurban line to Milton, eleven miles distant; the gas plant at Lewiston, Idaho; The Yakima Gas Company; the holdings of the Baker City, Oregon, Light and Power Company; the Willamette Valley Company's gas, electric light and water plants at the cities of Eugene, Albany, Cottage Grove, Corvallis, Independence, Dallas and Seaside, in Oregon; the Boise, Idaho, Traction Company, which operates the street cars at the Idaho capital, as well as furnishes power, and the lighting plant at Athena, Oregon. The directors are: Isaac W. Anderson, Robert E. Allen, R. F. Brackett, Thomas Michelson, A. K. Dice, S. A. Scott, Otto B. Frank, Robert Breese, Nicholas Lawson and Cary M. Rader. The bulk of the stock is owned by Rhodes, Sinkler & Butcher, of Philadelphia.

POWER AND LIGHT.

Albany, Ore.—Walter Mackey proposes to erect a power house here with a capacity of 33,000 horsepower.

Afton, Wyo.—The Afton Electric Light Co. has purchased the local electric light plant from B. E. Blussen.

Indian Head, Sask.—The city is preparing to spend $25,000 on improvements to the electric lighting system. T. E. Donnelly, mayor.

Casper, Wyo.—The Casper Electric Light Co. is contemplat-

ing the erection of a new and larger plant. Nathan C. Johnson, manager.

Prosser, Wash.—The Prosser Falls Land & Power Co. has purchased the property and franchises of the Prosser Electric Co.

Spokane, Wash.—Electric drills are to be installed at once on the property of the Coeur d'Alene Champion Mining Co. J. T. Omo, of this city, is a stockholder.

Kalispell, Mont.—Plans are being prepared by the Flathead Valley Water Power Co. for improvements to the Big Fork Electric Power & Light Co., to cost $50,000.

Dawson, Y. T.—William Ogilvie has organized a company with a capital of $10,000,000, and has purchased three modern dredges for operation on Stewart river.

Basin, Wyo.—The Basin Electric Light & Power Co. is contemplating the installation of additional boiler of 85 horsepower in the near future. F. E. Frisby, manager.

Seattle, Wash.—City Electrician Howard Joslyn is at work on plans for an underground system for the fire alarm wires and the police telephone and telegraph lines.

Hoquiam, Wash.—Work has been commenced clearing the site for the new power plant to be built by the Grays Harbor Railway & Light Co. Estimated cost, $200,000.

Bellingham, Wash.—The Great Excelsior Mining Co. will install a cyanide plant to have a capacity of 100 tons daily at its mine on the Mount Baker district. Estimated cost, $20,000.

West Seattle, Wash.—H. A. Edin has applied for a 25 year franchise for supplying the city with heating and illuminating gas; also for a 25 year franchise for electric light and power.

Spokane, Wash.—The Washington Electric Supply Co., capital $250,000, has been incorporated by Roger C. Kemp of Butte, Mont., Lester M. Simpson and William C. Jones.

Portland, Ore.—The Pacific Light & Power Co., capital $50,000, has been incorporated by C. P. Houston, Junction City; D. A. Houston, Oregon City; and Alexander Sweek, of this city.

Spokane, Wash.—The Mexico Mining & Development Co., capital $2,000,000, has been incorporated by Frank S. Farnest, Benjamin F. Parker, J. L. Reynolds, Joseph H. Horseman and George A. Cegal.

Olympia, Wash.—The Olympia Gas & Power Co., capital $100,000, has been incorporated by A. E. Wright, W. S. Dole and E. M. Kennard, of Portland, and Emil Martensen of this city.

Salem, Ore.—The Idaho-Oregon Light & Power Co., capital $7,000,000, has been incorporated to generate and utilize electricity for light and motive power in eastern Oregon and Idaho.

Lowell, Wash.—P. E. Hall, Jr., has made application to the county commissioners for a franchise to construct and operate a plant for the manufacture of gas for illuminating fuel or power purposes at this place.

Mullan, Idaho—A quantity of machinery, including a compressor plant and electric motors, has been ordered for the National mine, the bonanza silver-lead property on Snowstorm hill, near here. Estimated cost, $10,000.

Astoria, Ore.—The Astoria Electric Co. has awarded contract to W. S. Dole & Co., of Portland, for the construction of its new gas plant here to cost $12,000. C. A. Coolidge, superintendent.

Evanston, Wyo.—The Evanston Electric Light Co. has under consideration the installation of a 50 kilowatt direct current unit, Corliss engine and two 125 volt machines for operating an Edison three-wire system. L. E. Raney, manager.

Hermiston, Ore.—The Western Mutual Electric Co. has been incorporated with a capital of $50,000, by Jas. Lee, E. P. Todd, and others to supply electricity for lighting and power to the territory under the Umatilla government project.

Boise, Ida.—C. J. Franklin, who is in charge of the construction work at the Swan Falls plant reports they are making good progress. Four new water wheels have been set and other machinery is expected soon. There are to be two generators with a capacity of 750 kilowatts each.

Spokane, Wash.—It is reported that the Kendall Mining Co., which owns the Kendall mine in Montana and is controlled by Finch & Campbell, of this city, has purchased Terence McDonnell's water rights. An electric power plant will probably be erected at the Beaver site this summer.

Wallace, Idaho—The Snow Cliff Copper Mining Co., Ltd., capital $1,500,000, has been incorporated by E. A. Piersol, H. C. Small, P. M. Schaeffer, C. A. Burke and J. O. Burns. The Victor Mining & Smelting Co has been incorporated with a capital of $100,000 by Guy G. Bailey, James H. German, A. P. Reinhardt and Katherine A. Marshall.

Everett, Wash.—Eastern capitalists represented by M. Kirkpatrick, will erect a large power plant near Sultan. The dam will be 80 feet thick at the base and 30 feet on top, three separate power houses are to handle the released waters. The company will build a 17-mile railroad to handle its construction material.

INCORPORATIONS.

San Francisco, Cal.—The Fagan Electric Co. has been incorporated with a capital stock of $25,000, shares $10 each.

Eugene, Ore.—The Great Northern Mining Co., capital $100,000, has been incorporated by S. E. Wrightman, H. C. Mahon and George G. Gross.

Butte, Mont.—The Mines Exploration & Development Co., capital $50,000, has been incorporated by J. J. McHatton, J. L. Templeman, E. L. Mayo, W. L. Renick and John N. Kirk.

Hanford, Cal.—The East Cross Creek Ditch and Water Co. has been incorporated here, the directors being Robert Doherty, W. H. Smith, and Thos. McCarthy of Hanford.

San Diego, Cal.—The Distilled Water and Bottling Company has been incorporated with a capital stock of $20,000. The directors are F. W. Bradley, H. S. Richards and others.

Fresno, Cal.—The Coalinga Mohawk Oil Co. has been incorporated here with a capital stock of $500,000. Among those interested are P. S. Turnbull, C. G. and W. D. Wilcox, A. J. and R. W. Graham.

San Luis Obispo, Cal.—The Santa Rosa Oil Co. has been incorporated here with a capital stock of $500,000, shares $1 each. The directors are E. S. Rigdon, E. W. Carson, C. Bianchi and B. Corda.

International, Cal.—A local company has been organized to put in an electric light plant, a waterworks system, and an ice plant, with a capital of $20,000. At present the water is all packed in on burros.

San Luis Obispo, Cal.—The Bickmore Oil Co. has been incorporated here with a capital stock of $500,000. The directors are E. M. Payne, A. E. Campbell, C. P. Kaetzel, J. D. Campbell, and H. M. Payne.

Visalia, Cal.—The Linda Loma Water Co. has been incorporated here with a capital stock of $10,000, the major part of which is already subscribed. The directors are Fred and Daniel Sturm and G. W. Price.

Santa Cruz, Cal.—The Davenport Light and Power Com-

pany has been incorporated with a capital stock of $10,000. Those interested are E. E. Burgess of San Francisco, E. O. Klipphan of Sacramento, and J. S. Thompson of Mill Valley. Valley.

Santa Ana, Cal.—The Newport Bay Oil Company has been incorporated with a capital stock of $2,500,000. The directors of the concern are George Huntington, W. H. Beman, F. C. Fuller, C. F. Love, W. H. Bisbee, S. Cannon and others of Los Angeles.

North Yakima, Wash.—The Summit Copper Mining Co., capital $1,000,000, has been incorporated by Dan Sinclair, P. J. Bawalda, Mart Schichtl, John Nywening and Richard Strobach.

Seattle, Wash.—The Utah Copper Co., capital $600,000, has been incorporated by N. W. Chapman and Alex McCartney.

Berkeley, Cal.—Articles of incorporation have been filed by the Great Western Power Company, with a capital stock of $25,000,000. The corporation is building a large power plant on the west of the Feather River above Oroville, from which is proposed to run power lines into Berkeley, Oakland, and San Francisco. Henry Brown, a representative of the company, is in Berkeley looking over the field preparatory to asking for a franchise to run a pole line through various streets.

OIL.

City of Mexico.—The Mexican Central is installing oil burning engines as fast as they can build the tanks for storage along its line. Oil reservoirs are to be constructed at once between Monterey and Tampico and between Monterey and Torreon.

Crockett, Cal.—Although during the past year much construction work has been done at the refining plant of the Union Oil Company at Oleum, the information is given out that the plant will be increased to twice its present size because of the growth of business.

Bakersfield, Cal.—The Twenty-five Oil Co. has amended its articles of incorporation so that it now has the power to drill for and produce oil on its lands in the Midway field. Heretofore the company has not had this power under the articles of incorporation, but has been restricted to buying, selling, and leasing oil lands.

Portland, Ore.—Lower trans-continental tariffs on petroleum and its products are being published by the traffic departments of the railroads. Present freights of 78½ cents from Chicago and $1.06 from the Coast will be cancelled. Freight on turpentine in tank cars has been advanced from $1.10 to $1.25 per 100 pounds in tank cars from the East to North Coast terminals. A uniform standard of 7.4 pounds to the gallon of crude oil and 6.4 pounds for a gallon of refined oil has been adopted by the railroads.

Watsonville, Cal.—George E. Brookins, representing wealthy Los Angeles people, has completed negotiations for the sub-leasing from the Watsonville Oil Company of 200 acres of the Sargent ranch for oil boring operations. The location secured is considered a good one by oil experts. The Los Angeles company has plenty of money to prospect the ground thoroughly. The Watsonville Oil Company expects to increase its daily output considerably in a short time, when the casing of the deep well is perfected.

Bakersfield, Cal.—The arrival of the Standard pipe and the start of the work on the new pipe line has turned all eyes to the Midway and Sunset oil fields. Work on the new refineries, both on the Spreckels property and that of the Sunset Refining Company is being rushed as fast as possible. New development has been started on many of the leases. Among those who will put down new wells in the near future are the Krausbergers, the Bull's Head Oil Company, and the Birch Oil Company. Several new rigs are at work on the Monarch and Mascot properties.

Vallejo, Cal.—Fuel oil for the use of Vallejo and Napa consumers will be landed at Glen Cove, between this city and Benicia, and a pipe line is to be run from the bay inlet to these two cities. The oil will be piped across the country and sold at prices considerably below those now charged. George Ryerson is grading a ten-acre tract, which will be covered with oil tanks and other buildings necessary for the new enterprise. It is believed that the promoters of the new plan are also after the business of supplying the Government for the Mare Island Navy Yard, which uses vast quantities of fuel oil annually.

San Francisco, Cal.—Three of the largest petroleum companies of the Santa Maria Oil field and the Standard Oil Co. have consummated a deal that is without a parallel in the State. The contract, which represents $3,000,000, means an output of 145,000 barrels a month, a great stimulus to the industry. The Pinal, Brookshire, and New Pennsylvania are the independent companies, and the high price of 50 cents a barrel is quoted. All these independent companies adjoin one another in the Santa Maria field. Recently they and the Standard clashed over the price, which was quoted at 29 cents. They had offered to place the oil on the market and fight the Standard when the deal was made.

TELEPHONES AND TELEGRAPHS.

Coeur d'Alene, Idaho—The Interstate Telephone Company will expend $30,000 in improving its system in this city.

Boise, Idaho—The Independent Telephone Company is extending its lines to Nampa, Caldwell, Payette, Weiser and Emmett.

Fernie, B. C.—The Revelstoke Trail & Front Lake Telephone Co. will build a long distance line to Elkmouth and Hosmer.

Dexter, Ore.—The Dexter Telephone Company has applied for a franchise to extend its lines from Dexter to Springfield.

Spokane, Wash.—Contract has been awarded to Fife & Connor for $20,000 for blasting and stone work for ditches for the Home Tel. Co.

Tacoma, Wash.—The Home Tel. Co. will erect a one-story brick sub-station at once, to cost $15,000 at South Forty-fifth and L Streets. Plans by Russell & Babcock.

Wallace, Idaho.—Work has been commenced on the new building to be erected by the Rocky Mountain Bell Telephone Co. on Sixth Street, to cost $30,000.

Anaconda, Mont.—Work has been commenced remodeling the building formerly occupied by the Electric Light & Power Co., for the use of the Montana Independent Tel. Co.

Missoula, Mont.—The Peoples' Telephone Company has been incorporated with a capital of $10,000, by F. M. Taylor, K. D. Prescott, J. A. Moss and W. R. Hamilton.

Missoula, Mont.—The people of Orchard Homes and Cold Springs district are planning the construction of a telephone line. Messrs. Finkelnberg and Irving are interested.

Gig Harbor, Wash.—The Bay-Island Telephone Company has been organized by M. Magnuson, J. G. Schindler, H. Knapp, W. E. White, Wm. Schlaub, C. D. Fuller and R. Elmdorf.

Chehalis, Wash.—The Northwestern Long Distance Telephone Co., which purposes to connect Portland with Tacoma and

Seattle, has been granted a 50-year franchise by the Lewis County Commissioners.

Spokane, Wash.—F. C. MacGougan, manager of the Pacific Telephone and Telegraph Company, announces that from $500,000 to $750,000 will be expended in the betterment of the service here.

Wenatchee, Wash.—The Pacific States Telephone Co. has merged with the Farmers' Co., which will also handle long distance business. The Pacific States Co. will remain out of the field for ten years.

Dell, Mont.—Bids will be received by Walter J. Crowell, secretary of the Dell Tel. Co., until April 15, for the construction of 60 miles of telephone lines connecting Dell with Lima, Crabtree and Sheep Creek basin.

Gifford, Idaho.—A number of farmers' telephone lines, including the Riggers-Jacks line from Riggers' mill, the Hamberly-Slocum line from Hamberly ranch, and the Boyer-Bluett lines, are building into this place.

Eureka, Cal.—L. F. Puter, an attorney of this city, has been retained by the agent for a syndicate of Los Angeles capitalists to appear before the City Council to ask that a telephone franchise be offered for sale by the city.

San Jose, Cal.—There are persistent rumors here that a home telephone company is being formed and will ask for a franchise from the city at an early date. It is stated that petitions for franchises are even now being prepared.

Buffalo, Wyo.—The Klondike Telephone Co., capital $1,000, has been incorporated by J. Elmer Brock, R. Q. Watkins and G. E. A. Moeller. The company will construct, maintain and operate telephone lines in Johnson county.

Harington, Wash.—The P. S. Telephone Co. is building a line to Bluestem and thence to Davenport.

Umatilla, Ore.—The Farmers' Co-operative Telephone Co., capital $5,000, has been incorporated by Omer O. Stephens, De Witt C. Brownell and John W. Duncan.

Oakland, Cal.—At a meeting of the City Council last week a resolution of the Board of Public Works recommending that the telephone franchise awarded to W. A. Beasley on November 17, 1902, be declared forfeited as the grantee had failed to fulfill the terms of the franchise was referred to the ordinance and judiciary committee. William Thomas, president of the Home Telephone Co., filed with the City Council an affidavit that the company, in accord with the terms of its franchise, had already spent $250,000 in the installation of its system in Oakland.

San Jose, Cal.—It is probable that an ordinance will be adopted by the City Council within a week requiring that all wires, telegraph, telephone, and power, be placed underground. A committee from the Board of Fire and Police Commissioners has been investigating the matter and has formulated a report which is very sweeping in its recommendations.

Whitmore, Cal.—The farmers of this section have organized a telephone company for building a line to Redding, a distance of twenty-eight miles. The officers of the company, which is named the People's Telephone Co., are Jos. Covey, president, and Geo. R. Milford, secretary.

Oakland, Cal.—The Pacific Telephone and Telegraph Co. has started work on a new office at the corner of Forty-fifth Street and Piedmont Avenue. It will be a class A building, two stories in height. It is to cost $50,000 and be finished in October. There will be sixty operators in the new office.

Springfield, Ore.—The McKenzie Telephone Company has applied for a franchise to construct a line from this place to Leaburg. S. J. Godard and W. B. Wheeler were granted permission to build a telephone line from here to Wheeler's store, a distance of nine miles.

Waitsburg, Wash.—Stockholders of the Waitsburg Rural Telephone Company have granted a ten-year lease of the system to the Pacific States Telephone Company. The system comprises twenty-one lines and two hundred instruments.

San Francisco, Cal.—Emile J. Zimmer of the Pacific States Telephone Company was seriously but not fatally injured in a collision between a hack and a street car last week. Mrs. Wellington Gregg, wife of the cashier of the Crocker National Bank, who was in the hack with Zimmer, was unconscious for some time after the accident, and sustained severe injuries.

WATER WORKS.

Hemet, Cal.—Superintendent Salmon has begun work on the reservoir on Park Hill to contain 700,000 gallons of water. The reservoir will be formed by building a dam across a ravine near the top. Later a pumping plant will be installed.

San Francisco, Cal.—Bids have been advertised for by the Depot Quartermaster of the U. S. Army for the construction, plumbing, electric wiring, etc., of a pumping station and for the construction of a 300,000 gallon reservoir at a new military post, Kahauiki, Honolulu, H. T. Plans and specifications can be obtained at the office in San Francisco.

Rhyolite, Nev.—Dr. W. S. Phillips of Chicago, and Beatty and Malcolm McDonald, the Nevada mining operators, are at the head of a movement to build a great reservoir at Beatty to supply the contemplated mills of the Bullfrog district and to furnish water to the towns of Lee, Nev., and Lee, Cal., as well as to the mines of the Funeral Range. The new company will probably be incorporated with a capital stock of $1,000,000.

Goldfield, Nev.—The Colorado Nevada Mining and Prospecting Company of Denver has two claims in the northeastern portion of Death Valley. It is the intention of the company to install a graduated pipe from a spring two miles away to the mine and build a 20-stamp mill on the ground. A screen will be placed around each stamp, thus saving every particle of ore during the jamming process. W. J. Lee is superintendent of the company.

Madera, Cal.—The Madera Water Company reports that improvement of its water system will be made at once. A fire and a commercial pump are now being built at San Francisco for the plant. The capacity will be 60,000 gallons per hour under pressure of 100 pounds per square inch, which will be sufficient to furnish four fire nozzles with water. These will be built so they can be driven by either steam or electricity and can be changed from one to the other at short notice.

Oakland, Cal.—Members of the City Council made an examination of the People's Water Company's plant a week ago, in so far as the Alvarado pumping station and Lake Chabot dam and water shed were concerned. City Engineer Fred C. Turner accompanied the party. Automobiles were taken from Oakland to Alvarado, thence back to Lake Chabot. Louis Titus, the general manager of the company, acted as guide of the party. At an early date the Council will take up the subject of water rates for the coming fiscal year. Data and statistics as a basis of work on a rate-fixing ordinance are being compiled by J. H. Dockweiler, an expert engineer.

San Francisco, Cal.—Representatives of every commercial district improvement club and central labor organiza-

tion were present at a meeting held last week at the California Promotion Committee's rooms, at which they provided for the organization on May 25 of a central body to begin an active campaign to secure a water supply which shall be adequate to meet the needs of the city. A definite and decisive arrangement with the Spring Valley Co. will be one of the first efforts of the proposed organization. This arrangement, which may be made through the Board of Supervisors, is not to be so much an aid to the Spring Valley Co. as a relief to tide the corporation over and put it in such a shape that it may realize on its bonds and improve its service at least temporarily.

Oakland, Cal.—The People's Water Co. made public recently some of its plans relative to the development of its enormous holdings on the watershed of San Pablo Creek, the battle over which led in large measure to the sale of the old Contra Costa Water Co. to the Syndicate interests. The company has its plans prepared to construct a dam at the Clancy ranch on San Pablo Creek, which will form a reservoir 160 feet deep with an area along the creek five miles long to be flooded. This will provide a supply of 8,000,000,000 gallons of water, with a daily delivery capacity of 8,000,000 gallons. The Oakland Council was informed that the construction work would be completed in two years. The dam will consist of a heavy concrete core, earth faced. Tunnels are being bored on each side of the point selected in which to build the anchorage of the dam. A delivery tunnel, 7½ feet in diameter, will be constructed under Wildcat Creek to carry the water into Berkeley and thence to Oakland. The proposed works will more than double the existing supply. The Council will consider the new project in connection with the fixing of the water rates for the coming fiscal year.

TRANSPORTATION.

San Diego, Cal.—The Point Loma Electric Railway has applied for a franchise to construct a line from Winder and India Streets to Ocean Beach and has had the route fully surveyed.

Santa Ana, Cal.—The Santa Fe is preparing to make a fight for a franchise to run cars on East Second Street. People say that the company is getting ready to run an electric line from Huntington Beach to Santa Ana as a feeder for its traffic.

Chivatera, Mex.—Workmen are busy grading and laying track for the new motor line being built from the Capote framing shed to the Oversight mine. The equipment for the new road will consist of a motor and ten flat cars. The track will be eighteen inches wide.

Stockton, Cal.—An application has been made by the Central California Traction Company for a franchise for a term of forty years to operate cars for the transportation of passengers and freight on certain streets of this city. The cars will be operated by electricity.

Stockton, Cal.—The work of constructing the Central California Traction Co.'s line from Stockton to Lodi was commenced last week. The contractor will put 100 teams at work and expects to have the road in operation within six weeks. The line is already constructed from Stockton to the Calaveras River.

San Diego, Cal.—Within a week the work of double tracking the Third Street line will be under way. Material for this is being distributed along the line. Arrangements have been made for the construction of a bridge across the canyon running from Brooks to Pennsylvania Avenues. The work will cost thousands of dollars.

Vallejo, Cal.—Col. Fred Stock of San Francisco, who has been endeavoring to finance the San Francisco, Vallejo and Vaca Valley Railway and Steamship Co. and the Marysville and Downieville Railroad Co., is now in Paris and prospects are said to be good for a commencement of operations on both prospects late this summer.

Los Angeles, Cal.—Manager T. R. Gabel of the Los Angeles Pacific Railroad has notified the Board of Public Works that he will tear up South Hill Street from Second to Sixteenth to put in third rails. The object is to make the line broad gauge. Orders that no streets be torn up until after the fiesta period have been issued by the Board.

San Diego, Cal.—At a meeting of the Board of Supervisors last week bids were opened for the street railway franchise on El Cajon Avenue to La Mesa Springs. The application for the permission was made by E. Bartlett Webster and his bid was $100. The provisions of the grant are that work shall be begun within four months and completed within nine months.

Lincoln, Cal.—The Southern Pacific Co. is arranging for the immediate construction of an electric branch railroad from here to the Dairy Farm copper mine, which is nine miles from here. The Guggenheims, who own the mine, represent to the railroad that they will ship 1,000 tons of ore per day from the mine to the smelter which they are constructing at Baden on San Francisco Bay.

Fresno, Cal.—At the last session of the Board of Trustees a franchise was granted to the Monterey, Fresno, and Eastern road to pass through the city on F Street. Attorney Short, speaking for the traction company, said that his company would retire in favor of the railroad. The franchise was granted with the understanding that the railroad make satisfactory arrangements with the property owners along the line.

Lakeport, Cal.—Articles of incorporation have been filed by the Sonoma and Lake County Railway Co., which intends to construct an electric railway from Cloverdale to Lakeport with a branch to Kelseyville. The survey has been made from Cloverdale to Lakeport with a maximum grade of 3 per cent with one tunnel, the distance being 27 miles. The profiles and maps are being made out and as soon as weather permits work of construction will be begun.

Martinez, Cal.—W. S. Rheems has ordered from the General Electric Company a large quantity of material for the Martinez and Contra Costa electric line, and the General Electric Company has telegraphed the order East.

Los Angeles, Cal.—Bids will be received by the city until May 13 for a franchise for an electric railroad upon certain streets of the city. The proposed road is to run from Bimini Avenue along Third Street to Vermont Avenue and thence to Fourth Street. Certified checks must accompany all bids.

Sacramento, Cal.—Three hundred acres of land were purchased in Sacramento last week by F. J. Woodward and Chas. Butters, of Oakland, for $300,000. Butters holds large interests in the Key Route Co. and the Northern Electric Co. This land, it is said, will be used as the central point of operation for the extension of the Key Route company's lines to the North and South. According to rumors now prevalent here, plans are being laid by the Key Route to network the Sacramento and San Joaquin Valleys with electric railroads.

San Francisco, Cal.—The United Railroads has been directed by the Board of Supervisors to file a statement of its gross receipts for the years 1905 and 1906, which it has withheld from the city. E. P. E. Troy said that the company had furnished the financial papers with a statement that its receipts for 1905 were $7,066,000 and that testimony as to the receipts for 1906 was adduced from the arbitration

proceedings. The company offered to pay the sum of $25,114.81 as percentages on its gross receips for the year ending December 31, 1905. It claims that its records for 1905 were destroyed in the fire and it offered to settle its obligations with the city on the same basis as for the year 1904. The California Street Railway was directed to pay into the treasury $3,457.40 as percentage on its receipts for the year ending June 30, 1906.

Reno, Nev.—W. J. Harris, a director of the Farmers' and Merchants' Bank of this city, and J. E. Giroux, a prominent real estate man, have applied to the City Council for a franchise for an electric railroad in the northwestern portion of town. They intend to build a network of electric lines through the most important streets and connect that district with the University of Nevada and the business portion of the city. They promise to begin actual construction within thirty days after the granting of the franchise and that they will complete the work within a year. The Fleishakers of San Francisco, who own the Reno Traction Co.'s franchises over the streets in which Messrs. Harris and Giroux wish to extend their lines, are fighting the granting of the new franchises. The Fleishakers have not an exclusive franchise and as the people have become tired of waiting for the Fleishakers to extend their lines, they may call upon the Council to grant the new franchise.

FINANCIAL.

San Francisco, Cal.—The sale day of delinquent assessments levied payable on February 14 by the Rio Bravo Oil Company has been set on April 20.

San Francisco, Cal.—The annual meeting of the stockholders of the American River Electric Company has been called for April 17, 2 o'clock p. m. It will take place in this city at the corner of Grant Avenue and Bush Street.

Los Angeles, Cal.—May 15 will probably be settled as the day for holding the Owens River special bond election. The mayor will issue a proclamation declaring a holiday on that occasion and asking for a general celebration of the day, besides asking every one to vote for the $23,000,000 bond issue for the aqueduct project.

Santa Clara, Cal.—Santa Clara carried all but the bond proposition of $20,000 for the erection of a new city hall at the bond election recently. Among the items carried through were $21,000 for repairs to the municipal water and light plant, $9,000 for repairs to the school buildings and $30,000 for repairs for the sewers.

San Francisco, Cal.—Telegraphic advices sent to New York state that the United Railroads of this city have had to face an expenditure of $4,294,271 between March 1, 1906, and March 1, 1907, due to the earthquake and strike and betterments and improvements. This had all been provided for so that the company on March 1, 1906, had current liabilities amounting to $2,310,209, against which it had current assets of $2,177,410. In addition to this it had sold securities which were delivered in March that netted it an amount in excess of $900,000, and still left in the treasury over $2,500,000 of its 4 per cent consolidated bonds. It is claimed that by the sale of securities the $4,294,271 above mentioned has been provided at a cost not exceeding 5 per cent interest.

Los Angeles, Cal.—The right of any or every municipality in the United States, and more especially in California, to own public utilities is the important point at issue in a case brought before Judge Olin Wellborne of the Federal District Court last week. The suit is instituted as a test by the Edison Electric Company against the city of Pasadena to determine the right of the latter to buy the plant of the former. The electric corporation raises the contention that it is unconstitutional, under the Fourteenth amendment of the United States Constitution, for a city to obtain such ownership. The claim is made that no municipality in this State may engage in competition with private citizens, because the California law provides immunity from taxation to cities, thus affording them an unfair advantage, in violation of the constitutional amendment referred to. On account of the vital questions involved attorneys are watching every phase of the case. Able counsel represent both sides.

San Jose, Cal.—The answer of the Spring Valley Water Co. in the condemnation suit brought against it by the Bay Cities Water Co. has been filed last week. In the document the Spring Valley company fixes the value of the small strip of land which is in controversy at $1,000,000. The suit was brought by the Bay Cities company some time ago to condemn the land, which lies directly across the proposed reservoir site of the Bay Cities company at Coyote, where the company has erected extensive works for the diversion of the waters of the Coyote River. The plaintiff contended that the land had been purchased by the Spring Valley company, the Suburban Co., and the San Jose Water Co. for the purpose of hindering the construction of the reservoir. In answering the Spring Valley accuses the Bay Cities company of securing the water rights for speculative purposes only. It avers that the land in question is essention to its own business and that it is worth $1,000,000. The indications are that there will be a bitter legal controversy over a spot of land that is intrinsically almost valueless.

Los Angeles, Cal.—Local capitalists interested in the Home Telephone Company have given out the following statement: "Statement concerning the Home Telephone franchise to the city of San Francisco: Cash paid for franchise to the city of San Francisco, $100,000. The requirement was that the price be in gold, and this being impossible right after the fire, $25,000 was paid to the city and $75,000 was given by certified check to the relief fund. Under the provision of the franchise the city acquires the use, free of charge, of 600 telephones, the estimated to the city being $8 per month each, or $57,600 per year, being five per cent. interest on nearly $2,500,000. The telephone company under the Broughton Act, is required to pay two per cent. of the gross receipts after five years to the city granting the franchise. The gross receipts after five years are estimated to be the proceeds of 50,000 telephones paying an average of $6 per telephone per month. This would amount to $300,000 per month, two per cent of which would total not less than $72,000 per year. It has been stated by one familiar with franchises granted by municipalities that the actual consideration paid for the telephone franchise in San Francisco was the highest ever paid by any corporation for any purpose in any city in the world."

TRANSMISSION.

Petaluma, Cal.—It has been decided that the Petaluma Gas and Electric Co. will build a steam power plant here of capacity 2,000 horsepower for the generation of electricity.

Mexico City, Mex.—The council of administration of the Electric Power Transmission Co. of the State of Hidalgo announces that at the general meeting of the shareholders recently held it was decided to acquire two more waterfalls, erect more electric generating plants, and issue more stock.

San Francisco, Cal.—Reviewing the electrical workers' strike situation, Secretary George E. Russell said last week

"Work has come to a standstill on twenty-five large concrete buildings in course of construction and on countless smaller structures. The George Wellington Company has been obliged to cease operations on ten structures, and the Frank Gilbreth Company on at least an equal number."

Red Bluff, Cal.—A great many water claims have recently been filed here and the water in all the main streams has been appropriated. Recently two claims were filed for water from the Antelope Creek, each for 15,000 inches of water. The appropriators are C. A. Buress, L. J. Joiner, and E. Finley. The water is to be used for power purposes.

Stockton, Cal.—Ground has been broken by the American River Electric Power Co. for the erection of its immense new power house on Banner Island. Nearly all the machinery for the equipment of the plant is on the ground, and the remainder is on cars on the way from the East. The work of putting in the concrete foundations will be hurried to completion and the machinery will be installed soon after. This plant will be to supply local customers, notably the traction company.

Bishop, Cal.—The application of the Mono Power Company for a river water right has been approved by the Secretary of the Interior. The company has had a long fight against the opposition of Los Angeles. The report, which was approved by the President, sustained all the contentions made by the Mono Power Company and against the city of Los Angeles. The grant is for the company's full claim, except in the case of construction of the Long Valley reservoir; should that be built the company will be restricted to 160 second feet, or 8,000 inches.

Stockton, Cal.—Millions of dollars are being expended in the development of the Stanislaus Electric Company's properties in Tuolumne and Calaveras Counties. One of the greatest electrical enterprises in the West is being developed in the watershed of the Stanislaus River with a generating plant to be located on the river a few miles above the Melones mine. Thence power lines will be run to Stockton and thence to San Francisco. The general distributing point for the company's operations is at Middle Camp in Tuolumne County, to which point a narrow railroad has been built from a connecting station on the Sierra Railway. The work has progressed far enough to warrant the location of the pole line which is to be built to Stockton.

Watsonville, Cal.—The visit of General Manager Stirling and Secretary Fitzpatrick of the Coast Counties Light and Power Co. to this place last week, while virtually a visit of inspection, also portends a number of changes in the operation of the plants supplying Santa Cruz and Watsonville with light and power. It will be fully a year before the changes are completed, and almost the last move to be made is the one bearing on a reduction of the size of the auxiliary plant now in operation at Watsonville. The company's plan, as briefly outlined, is to establish a large central plant at Big Creek at which the electricity is to be generated, and a large substation or distributing plant at Santa Cruz, with a smaller auxiliary plant at Watsonville to be used in emergency. The generating plant at Big

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Dietzgen Co., Eugene

Boilers
Henshaw, Bulkley & Co.
Hunt, Mirk & Co.
Keystone Boiler Works
Moore, C. C. & Co., Inc.
Risdon Iron Works
Standard Electric Works
Tracy Engineering Co.

Boiler Compounds
Dearborn Drug & Chem. Wks.
Johns-Manville Co., H. W.

Buffers
Northern Electrical Mfg. Co.

Chemists and Chemical

Building Material
Johns-Manville Co., H. W.

Building Paper
Johns-Manville Co., H. W.

Circuit Breakers
Fork Wayne Electric Works
Century-Klein Electric Co.

Compressed Air
Pacific Electric Mfg. Co.
Pacific Elec. Mfg. Co.

Condensers
O. C. Goeris & Co.
Moore, Chas. C. Co., Inc.
Rix Comp Air & Mach. Co.
C. H. Wheeler Mfg. Co.

Conduits
American Circular Loom Co.
American Conduit & Mfg. Co.
Tel. and Elec. Equipment Co.
Century-Klein Electric Co.

Conduit Fixtures
American Conduit & Mfg. Co.
Century-Klein Electric Co.
Tel. and Elec. Equipment Co.

Cooling Towers
O. C. Goeris & Co.
Moore, Chas. C. Co., Inc.
C. H. Wheeler Mfg. Co.

Cross Arms
Carter & Co., George E.
Century-Klein Electric Co.
Tel. and Elec. Equipment Co.

Drawing Materials
Dietzgen Co., Eugene

Dynamos and Motors
Allis-Chalmers Co.
Brooks-Follis Elec. Corp.
California Electrical Works
Century-Klein Electric Co.
Pacific Electric Mfg. Co.
Fort Wayne Electric Works
General Electric Co.
Holtzer-Cabot Elec. Co.
Northern Elec. Mfg. Co.
Standard Electrical Works
Tel. and Elec. Equipment Co.
Westinghouse Elec. & Mfg. Co
Wagner Elec. Mfg. Co.

Elevators
Van Emon Engineering Co.

Electric Car Heaters
Johns-Manville Co., H. W.
Northern Electrical Mfg. Co.

Electric Grinders
California Electrical Works
Northern Electrical Mfg. Co.
Tel. and Elec. Equipment Co.

Electric Heating Devices
Johns-Manville Co., H. W.

Electrical Instruments
Cutter Co., The
Century-Klein Electric Co.
Fort Wayne Electric Works
General Electric Co.
Tel. and Elec. Equipment Co.
Westinghouse Elec. & Mfg. Co.
Weston Elec. Instrument Co.

Electrical Machinery
California Electrical Works
Northern Electrical Mfg. Co.
Standard Electrical Works
Century-Klein Electric Co.

Electric Polishers
Northern Electric Mfg. Co.

Electric Railway Appliances
Pierson, Roeding & Co.
Johns-Manville Co., H. W.

Electrical Supplies
California Electrical Works
Century-Klein Electric Co.
Standard Electrical Works
Tel. and Elec. Equipment Co.

Electric Ventilating Fans
Century-Klein Electric Co.
California Electrical Works
Northern Electrical Mfg. Co.

Engines, Boilers, Heaters, etc.
Allis-Chalmers Co.
Henshaw, Bulkley & Co.
Moore, Chas. C. Co., Inc.

Electric Watchman's Clocks
Pacific Fire Extinguisher Co.
Tel. and Elec. Equipment Co.

Engineers, Chemical
Smith, Emery & Co.
Moore & Co., Chas. C., Inc.
Ohmen Engine Works
Standard Elec. Works
Tracy Engineering Co.
Westinghouse Machine Co.

Engines, Gas and Gasoline
Allis-Chalmers Co.
Henshaw, Bulkley & Co.
Moore & Co., Chas. C., Inc.
Westinghouse Machine Co.

Engineers and Contractors
Brooks-Follis Elec. Corporat'n
Byllesby & Co., H. M.
California Electrical Works
Cannon, Edward F.
Century-Klein Co.
Copeland, Clem A.
Doble Co., Abner
Cory, C. L.
General Electric Co.
Hunt, Dillman, Meredith & Allen
Jackson, D. C. & W. P.
Smith, Emery & Co.